RCRA ENVIRONMENTAL INDICATORS
PROGRESS REPORT: 1995 UPDATE

Office of Solid Waste
June, 1996

TABLE OF CONTENTS

EPA's Office of Solid Waste (OSW) is continuing to make progress in developing and reporting environmental indicators to measure progress in the Resource Conservation and Recovery Act (RCRA) program. In 1992, OSW published a report summarizing early progress in the development of environmental indicators and discussing an implementation plan for the future.[1] OSW began reporting 12 indicators in a second report published in 1993.[2] This report, the third in the series, updates 11 of these indicators and adds one new indicator.

Chapters 2, 3, and 4 of this report discuss indicators for three major components of the RCRA program: waste minimization, safe management, and corrective action. These are the three major goals OSW has defined for the program, consistent with the objectives and themes of the RCRA statute.

- Waste minimization indicators are being developed to help determine the effect of RCRA program activities to reduce the quantity, toxicity, and hazardous properties of wastes; conserve natural resources by reducing the use of raw materials; and reduce the use of toxic materials in production. OSW is just beginning efforts in some of these areas.

- Safe management indicators are being developed to measure the effectiveness of program activities to prevent harm to human health and the environment from the mismanagement of wastes after they are generated. This category of indicators encompasses the safe management of wastes from "cradle to grave," i.e., from the point of generation through transportation, storage, treatment, and final disposal. A wide variety of program activities are covered in this category, including waste manifesting; treatment of wastes prior to land disposal (e.g., best demonstrated available technology [BDAT]); location standards for waste management units; standards for the design, operation, and closure of waste management units; and monitoring to identify releases from waste management units to ensure that the units' design and operating practices are effective in preventing releases.

- Corrective action indicators are being developed to measure the effectiveness of activities to control and clean up contamination from waste at RCRA facilities. Activities covered include assessing sites to determine the need for corrective action, stabilizing and cleaning up releases, and prioritizing site assessment and cleanup based on human health and

[1]EPA. 1992. RCRA Environmental Indicators: FY 1991 Progress Report and Implementation Plan for the Future. Office of Solid Waste. Communications, Analysis, and Budget Division. January 1992.

[2]EPA. 1992. RCRA Environmental Indicators: FY 1992 Progress Report. Office of Solid Waste. Communications, Analysis, and Budget Division. April 1993.

environmental risks. Two new indicators are being developed to track the actual environmental results of remediation activities.

Appendix A provides a list of acronyms. A brief introduction to environmental indicators and their role in EPA programs is presented in Appendix B. Appendix C briefly discusses the data sources currently being used to report RCRA environmental indicators. Appendix D provides a discussion of newly regulated hazardous wastes, i.e., wastes that became subject to regulation under RCRA Subtitle C between 1989 and 1991. References for this report are listed in Appendix E.

Six waste minimization indicators are being reported in this chapter, three for hazardous wastes and three for municipal solid wastes.

Subtitle C Indicators:

- Subtitle C Indicator No. 1A. Quantities of Primary Hazardous Waste Generated in 1991, By SIC Code
- Subtitle C Indicator No. 1B. Comparison of 1989 and 1991 Quantities of Primary Hazardous Waste Generated, By SIC Code
- Subtitle C Indicator No. 2A. Quantities of Hazardous Wastewater and Non-wastewater Generated in 1991, By SIC Code
- Subtitle C Indicator No. 2B. Comparison of 1989 and 1991 Generated Quantities of Non-wastewater, By SIC Code
- Subtitle C Indicator No. 3A. Trends in the Recycling/Recovery of RCRA Hazardous Waste, 1985 to 1991
- Subtitle C Indicator No. 3B. Comparison of 1989 and 1991 Recycling/Recovery of Hazardous Wastewater and Non-wastewater

Subtitle D Indicators:

- Subtitle D Indicator No. 1. Trends in Total Municipal Solid Waste Generation, 1960 to 1993
- Subtitle D Indicator No. 2. Trends in Per Capita Municipal Solid Waste Generation, 1960 to 1993
- Subtitle D Indicator No. 3. Trends in the Recovery of Municipal Solid Waste for Recycling (Including Composting), 1960 to 1993

1A. Quantities of Primary Hazardous Waste Generated in 1991, By SIC Code

Exhibit 2-1 presents the distribution by SIC code of primary hazardous waste generated in 1991. The data were derived from the 1991 Biennial Reporting System (BRS) Reporting Database. The quantities reported in this exhibit include only "primary waste" (i.e., waste generated on site from production processes, service activities, or the management of non-hazardous waste). "Secondary wastes," which are excluded from this report, are hazardous waste residuals resulting from the treatment or recycling of previously existing hazardous waste such as solids resulting from stabilization processes and sludges resulting from the treatment of hazardous wastewater. Quantities of secondary waste are excluded because they are not the target for waste minimization. In fact, an increase in secondary waste generation could indicate that more hazardous waste is being treated or recycled.[1] This exhibit also excludes confidential business information (CBI) data[2] and, to the extent permitted by the Biennial Report data submissions, hazardous wastes managed exclusively in units exempt from RCRA permitting requirements. Such wastes are mostly wastewaters treated in tanks and discharged to a Publicly-Owned Treatment Works (POTW) or to surface water under a National Pollutant Discharge Elimination System (NPDES) permit. In cases where it was difficult to determine from the generator's submission to the BRS whether the waste was managed in a RCRA-regulated or RCRA-exempt process, the waste was assumed to be RCRA-regulated.

Of the approximately 289 million tons of total RCRA hazardous waste generated in 1991, 246 million tons were primary hazardous waste. Exhibit 2-1 presents the proportion of these 246 million tons of primary hazardous waste generated by various industries. As shown in Exhibit 2-1, manufacturers of Chemicals and Allied Products (SIC 28) are responsible for 53.4 percent, or 131.4 million tons, of all primary hazardous waste generation. Within this industry, over 50 percent is generated in Industrial Organic Chemicals manufacturing (SIC 2869) and another 30 percent is generated in the manufacture of Agricultural Chemicals Not Elsewhere Classified (SIC 2879).

The Petroleum Refining and Coal Products (SIC 29) industry is responsible for slightly more than 92 million tons, representing 37.6 percent, of total primary waste generation. Within this industry, Petroleum Refining (SIC 2911) generates 99.9 percent of this waste.

---

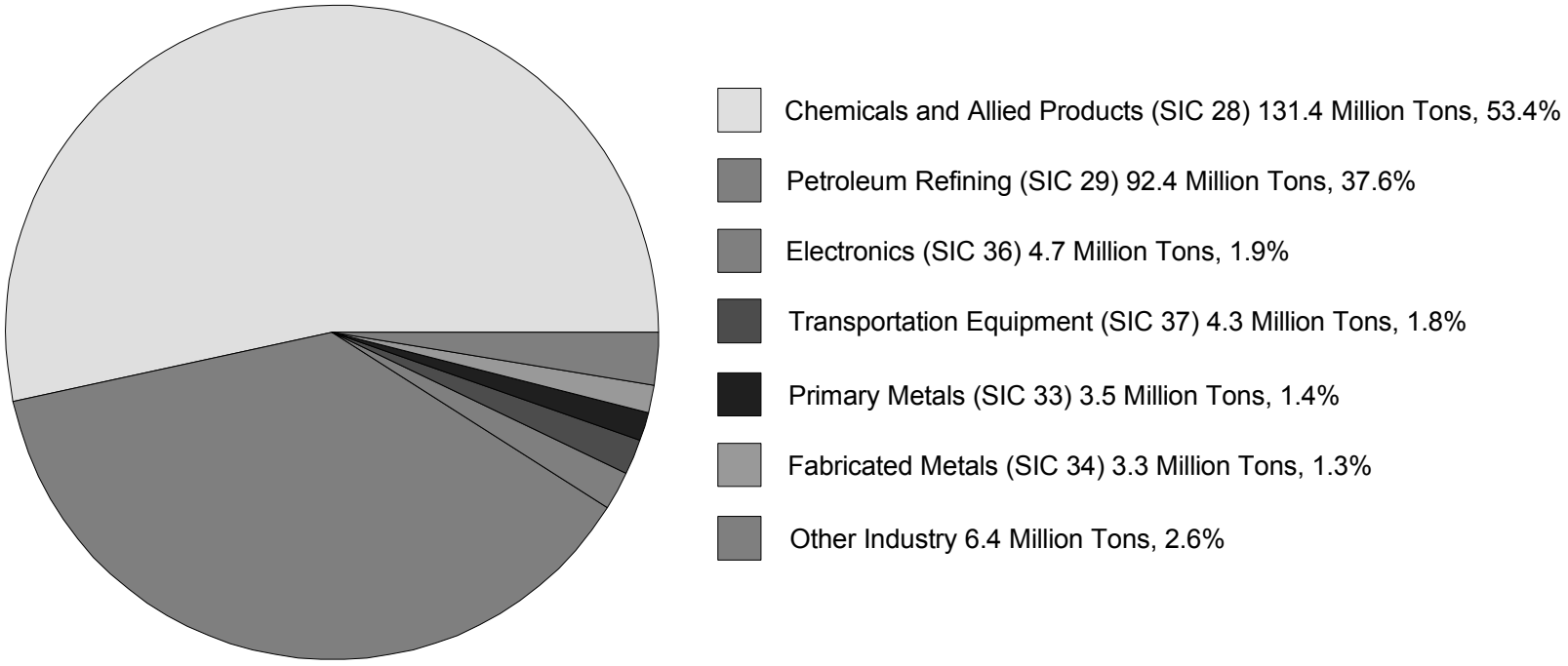
[1] Although "primary waste" excludes residuals from hazardous waste treatment practices, it does not exclude residuals resulting from treatment mandated by other statutes, such as the Clean Air Act. Thus, RCRA primary hazardous wastes may increase as a result of the implementation of other statutes.

[2] "...[T]rade secrecy and other related legal concepts...may give...a business the right to preserve the confidentiality of business information and to limit its use or disclosure by others in order that the business may obtain or retain business advantages is derives from its rights in the information" (40 CFR Part 2, Subpart B).

Exhibit 2-1

Subtitle C Indicator No. 1A. Quantities Of Primary Hazardous Waste Generated in 1991, By SIC Code

Waste Generation Quantities Include Primary Waste Only



1991 Primary Hazardous Waste Quantity = 246 Million Tons

Source: 1991 Biennial Reporting System

Other industrial sectors that generate one percent or more of the nation's primary hazardous waste are:

- Electronic and Other Electric Equipment (SIC 36) – 1.9 percent (predominantly semiconductors and related devices);
- Transportation Equipment (SIC 37) – 1.8 percent (mostly aircraft engines and equipment);
- Primary Metals Industries (SIC 33) – 1.4 percent (led by blast furnaces and non-ferrous industries not elsewhere classified); and
- Fabricated Metal Products Except Machinery and Transportation Equipment (SIC 34) – 1.3 percent (primarily plating and polishing and small arms ammunition).

The remaining industries generate 2.6 percent of the primary hazardous waste and have been collapsed into the "Other Industry" category.

1B. Comparison of 1989 and 1991 Quantities of Primary Hazardous Waste Generated, By SIC Code

Exhibit 2-2 compares the quantity of primary RCRA hazardous waste generated in 1991 with the quantity generated in 1989. The exhibit also shows, for 1991, the proportion of total waste generated that is newly regulated hazardous waste.

Newly regulated hazardous waste refers to solid waste that is brought into the RCRA Subtitle C domain through the promulgation of regulations, as authorized under RCRA. Defining additional solid wastes as hazardous can result in an apparent increase in total hazardous waste volumes, even when volumes of previously regulated hazardous waste are actually decreasing. Between the 1989 and the 1991 BRS reports, EPA brought six previously unregulated wastes under Subtitle C regulatory control and changed the designation of a seventh waste type. See Appendix D for a discussion of the seven wastes that became subject to regulation under RCRA Subtitle C between 1989 and 1991.

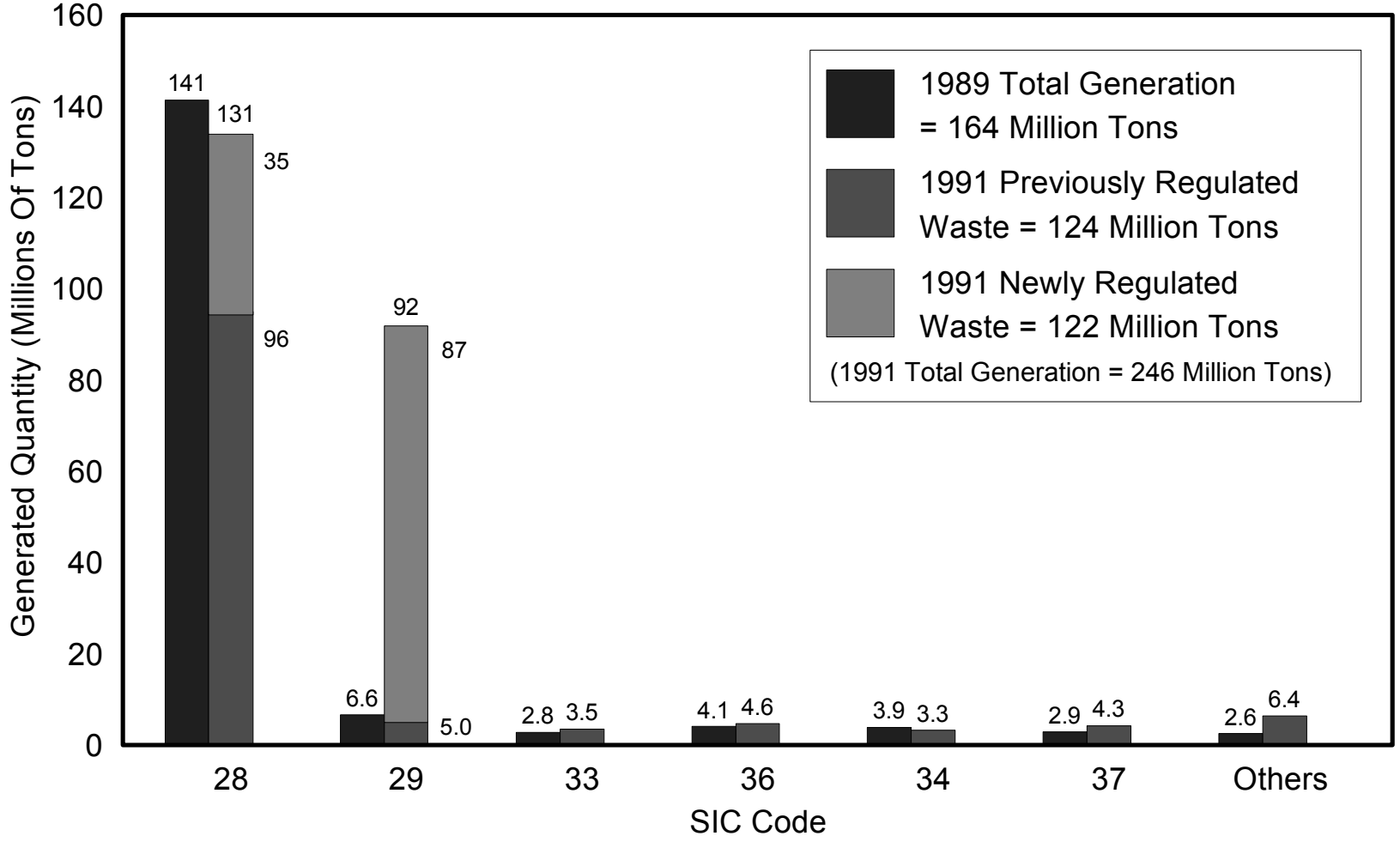
The total quantity of primary RCRA hazardous waste generated in 1991 (246 million tons) was 81.8 million tons more than the 164.2 million tons generated in 1989, representing an increase of 50 percent. Generation of newly regulated waste accounted for almost 50 percent of total primary waste generation in 1991. Primary waste generation actually would have decreased 25 percent if newly regulated wastes were not included.

However, the majority of newly regulated waste is generated in only two of the top six industries:

- Over 99 percent of newly regulated waste was generated by Petroleum Refining and Coal Products (SIC 29) and Chemicals and Allied Products (SIC 28). These industrial sectors generated 71.3 percent and 28.3 percent, respectively, of newly regulated waste. In fact, 71 percent (87.3 million tons) can be attributed solely to Petroleum Refining (SIC 2911).

Exhibit 2-2

Subtitle C Indicator No. 1B. Comparison of 1989 and 1991 Quantities of Primary Hazardous Waste Generated, By SIC Code



Source: 1989 and 1991 Biennial Reporting Systems

Note: The 1989 data presented in this exhibit are different from the 1989 data presented in the April 1993 RCRA Environmental Indicators report. The data presented here are more accurate due to additional quality assurance/quality control procedures performed on the database subsequent to the previous report. In addition, this exhibit excludes CBI data, which were included in the earlier report.

- Waste generated by Petroleum Refining and Coal Products (SIC 29) increased 14 times from 6.6 million tons to 92.4 million tons. Without newly regulated waste, waste generation by this industry would have actually decreased 23 percent.

- Primary waste generated by Chemicals and Allied Products (SIC 28) decreased 9.9 million tons, or 7 percent. Newly regulated waste accounts for 25 percent of this waste. Without newly regulated waste, primary waste generation in this industry would have been 44.6 million tons, representing a decrease of 32 percent.

These two industries are, in general, generating less waste. However, more of the waste that they generate is now considered hazardous.

The remaining four industries were not significantly affected by generation of newly regulated waste.

- Waste generated by the Fabricated Metal Products, Except Machinery and Transportation Equipment (SIC 34), industry decreased almost 16 percent, or 600,000 tons. Newly regulated waste accounts for only 0.18 percent of this industry's primary waste generation.

- Electronics and Other Electric Equipment (SIC 36) increased its waste generation 14 percent to 4.7 million tons. However, newly regulated waste accounts for only 0.4 percent of this quantity.

- Waste generation increased 50 percent, or 1.4 million tons, in the Transportation Equipment (SIC 37) industry. Less than 0.1 percent of this waste is newly regulated.

- Primary Metal Industries (SIC 33) increased their waste generation by almost 30 percent to about 2.8 million tons. Newly regulated waste accounts for only 0.3 percent of this industry's primary waste generation.

The top six industries, in terms of quantity of waste generated, are the same in 1991 as they were in 1989, except that Fabricated Metals (SIC 34) dropped from fourth to sixth. These six industries also account for a similar proportion of the total primary waste generated (97.4 percent in 1991 and 98.6 percent in 1989).

2A. Quantities of Hazardous Wastewater and Non-wastewater Generated in 1991, By SIC Code

Data from the 1991 BRS, presented in Exhibit 2-3, show that 97.2 percent of the primary hazardous wastes shown in Exhibit 2-1 are wastewaters.[3] The remaining wastes are non-wastewater (i.e., sludges and solids), and comprise 2.8 percent of all primary wastes generated. Waste generation is broken out into wastewater and non-wastewater to better monitor the types of waste generation changes that might occur. As above, this indicator reports only primary waste and excludes CBI data and, to the extent permitted by the data submissions, hazardous wastes managed exclusively in units exempt from RCRA permitting requirements

[3] Wastewaters are defined in the October 1992 BRS Core Exception and Verification Report Technical Instructions as hazardous waste whose form codes indicate aqueous waste, scrubber water or leachate, or whose system type codes indicate aqueous treatment, underground injection, direct discharge to sewer, or direct discharge to surface water.

Exhibit 2-3 also shows the distribution of non-wastewater generation among industries. The Chemicals and Allied Products industry (SIC 28) dominates non-wastewater generation (42.7 percent), but not as dramatically as it does total primary waste generation. Non-wastewater generation in the Chemicals and Allied Products industry is led by the manufacturing of industrial organic and inorganic chemicals. The second largest generator of non-wastewaters is Primary Metal Industries (SIC 33), which is responsible for 17.1 percent of all non-wastewater generation (primarily blast furnaces). Other industries that generate relatively high quantities of non-wastewaters are Petroleum Refining and Coal Products (SIC 29) and Fabricated Metals (SIC 33).

2B. Comparison of 1989 and 1991 Generated Quantities of Hazardous Non-wastewater, By SIC Code

Exhibit 2-4 compares the quantity of non-wastewater generated in 1991 with the quantity generated in 1989. The exhibit also shows, for 1991, the proportion of total non-wastewater generated that is newly regulated as hazardous. See Appendix D for a discussion of newly regulated wastes, i.e., wastes that became subject to regulation under RCRA Subtitle C between 1989 and 1991.

The total amount of RCRA hazardous non-wastewater generated in 1991 (almost 7.4 million tons) was 2.8 million tons more than the 4.6 million tons generated in 1989, for an increase of 60 percent. Unlike total primary waste generation, this increase is not attributable to newly regulated waste, which is responsible for only 6 percent of total non-wastewater generation in 1991. Therefore, generation of non-wastewater has, on average, increased.

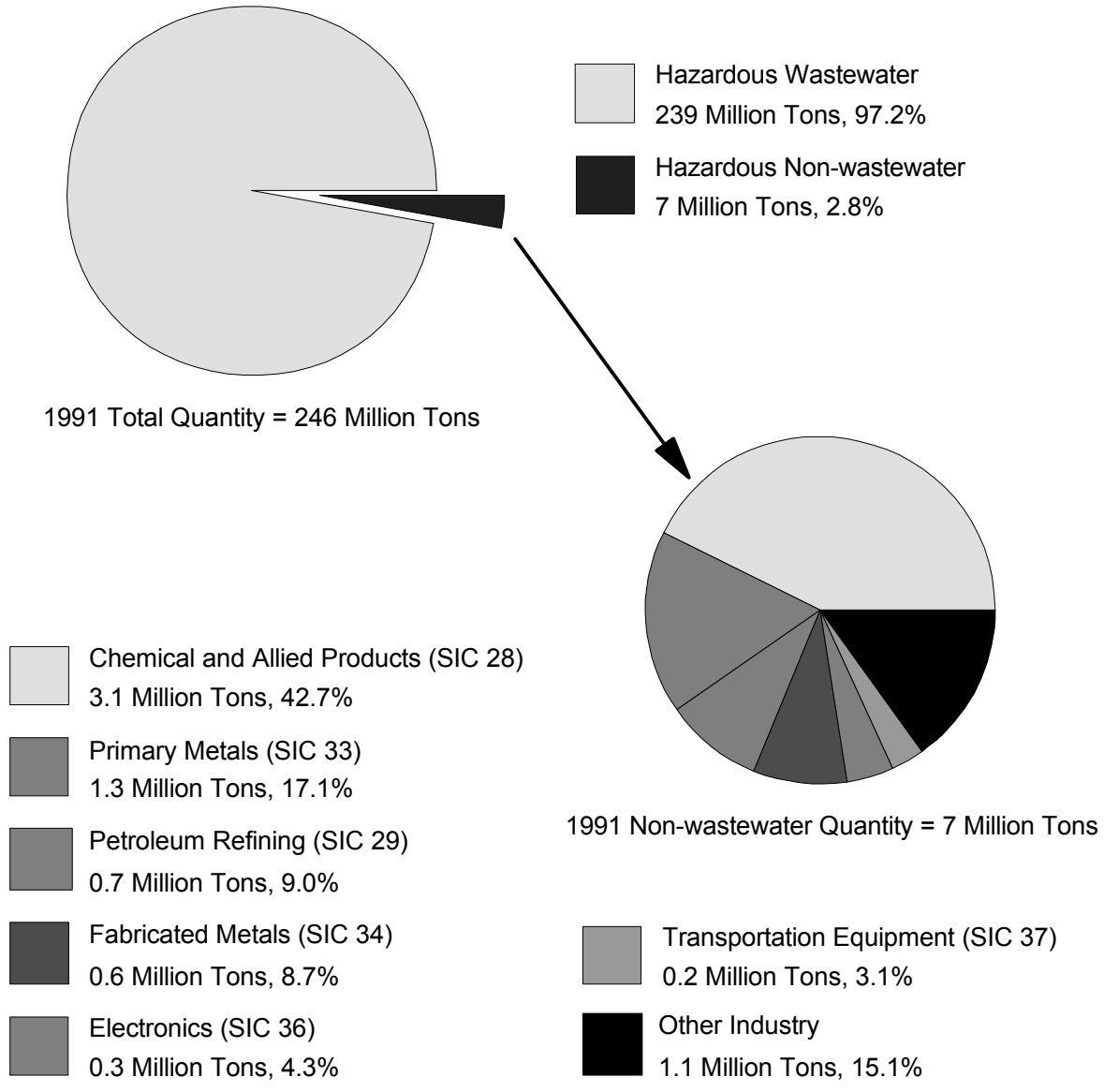
In analyzing the changes between non-wastewater generated in 1989 and previously regulated and newly regulated non-wastewater generated in 1991, the data indicate the following:

- The majority of newly regulated non-wastewater was from Petroleum Refining and Coal Products (SIC 29) and Chemicals and Allied Products (SIC 28). These industries accounted for 63.3 percent and 14.9 percent, respectively, of newly regulated non-wastewater. In fact, 63 percent (298,000 tons) can be attributed solely to Petroleum Refining (SIC 2911).

- The categories in which newly regulated non-wastewater accounted for the majority of non-wastewater generation were Pipelines, Except Natural Gas (SIC 46) and Water Transport (SIC 44). Newly regulated non-wastewaters accounted for 90 percent and 75 percent of these categories, respectively. However, these categories together accounted for only 0.3 percent of total non-wastewater generation.

Exhibit 2-3
Subtitle C Indicator No. 2A. Quantities of Hazardous Wastewater and Non-wastewater Generated in 1991, By SIC Code

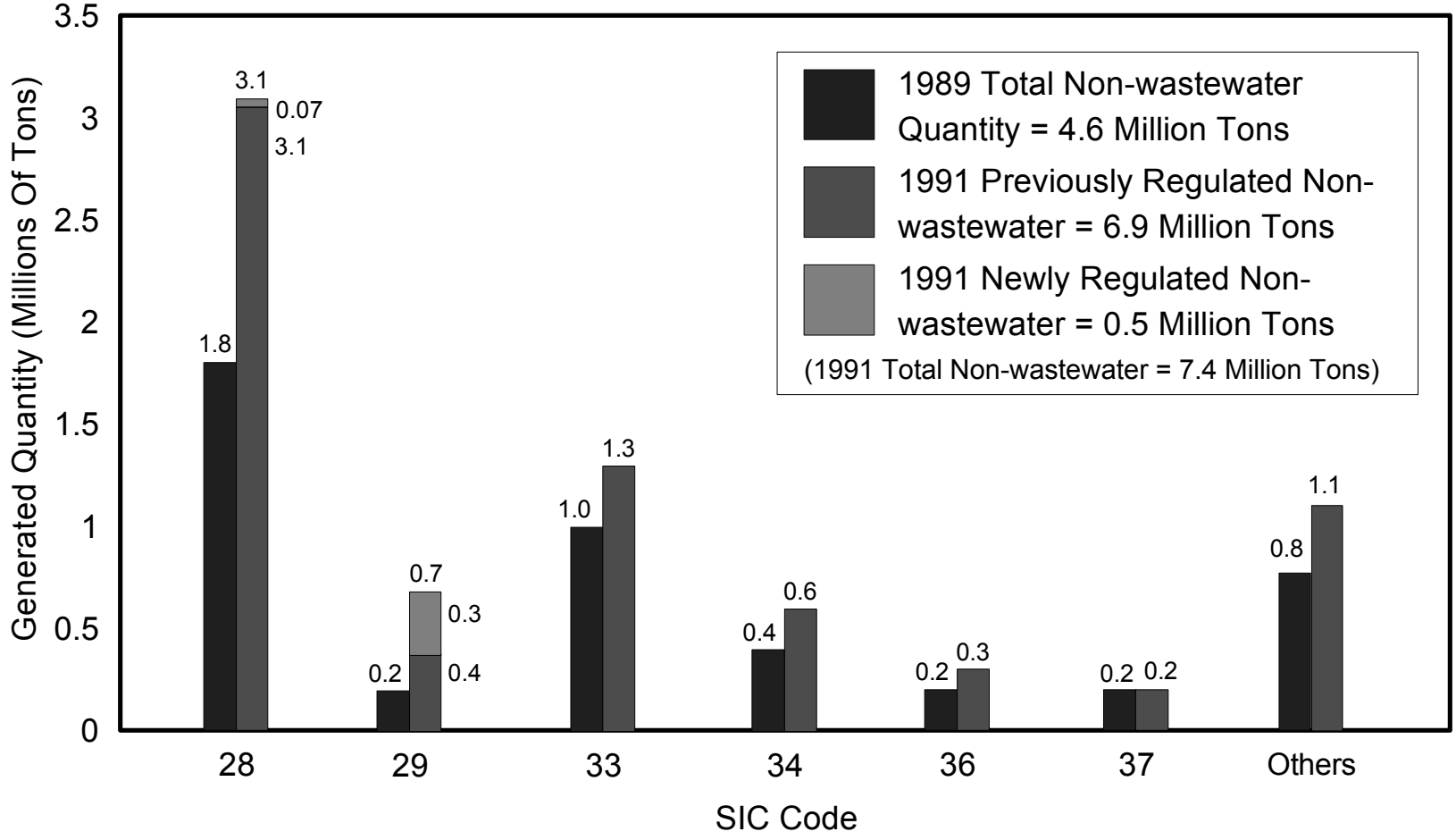
Waste Generation Quantities Include Primary Waste Only



Source: 1991 Biennial Reporting System

Exhibit 2-4

Subtitle C Indicator No. 2B. Comparison of 1989 and 1991 Generated Quantities of Hazardous Non-wastewater, By SIC Code



Source: 1989 and 1991 Biennial Report Systems

Note: The 1989 data presented in this exhibit are different from the 1989 data presented in the April 1993 RCRA Environmental Indicators report. The data presented here are more accurate due to additional quality assurance/quality control procedures performed on the database subsequent to the previous report. In addition, this exhibit excludes CBI data, which were included in the earlier report.

Between 1989 and 1991, hazardous non-wastewater generation increased in all of the top six industries. None of these increases is attributable to newly regulated waste.

- Non-wastewater generated by Chemicals and Allied Products (SIC 28) increased 1.3 million tons, or 71 percent. Newly regulated non-wastewaters account for only 2.2 percent of this waste.

- Primary Metal Industries (SIC 33) increased their non-wastewater generation by about 25 percent to 1.26 million tons. However, only 0.5 percent of this waste is newly regulated.

- Non-wastewater generated by Petroleum Refining and Coal Products (SIC 29) increased more than three times to 665,000 tons. Although 45 percent of this waste is newly regulated, this industry's generation would have increased 76 percent, even with only previously regulated waste.

- Non-wastewater generated by the Fabricated Metal Products (SIC 34) industry increased 63 percent, or 246,000 tons. Only 0.8 of this waste is newly regulated.

- Electronics and Other Electric Equipment (SIC 36) increased its non-wastewater generation 77 percent to 320,000 tons. Newly regulated non-wastewater accounts for six percent of this quantity.

- Non-wastewater generation increased 17 percent, or 32,000 tons, in the Transportation Equipment (SIC 37) industry. Only one percent of this waste is newly regulated non-wastewater.

The top six industries, in terms of quantity of non-wastewater generated, are the same in 1991 as they were in 1989, except that Fabricated Metals (SIC 34) rose from fourth to third and Electronic and Other Electrical Equipment (SIC 36) rose from sixth to fifth. These six industries account for a similar proportion of the total non-wastewater generated (85 percent in 1991 and 79 percent in 1989).

3A. Trends in the Recycling/Recovery of RCRA Hazardous Waste, 1985 to 1991

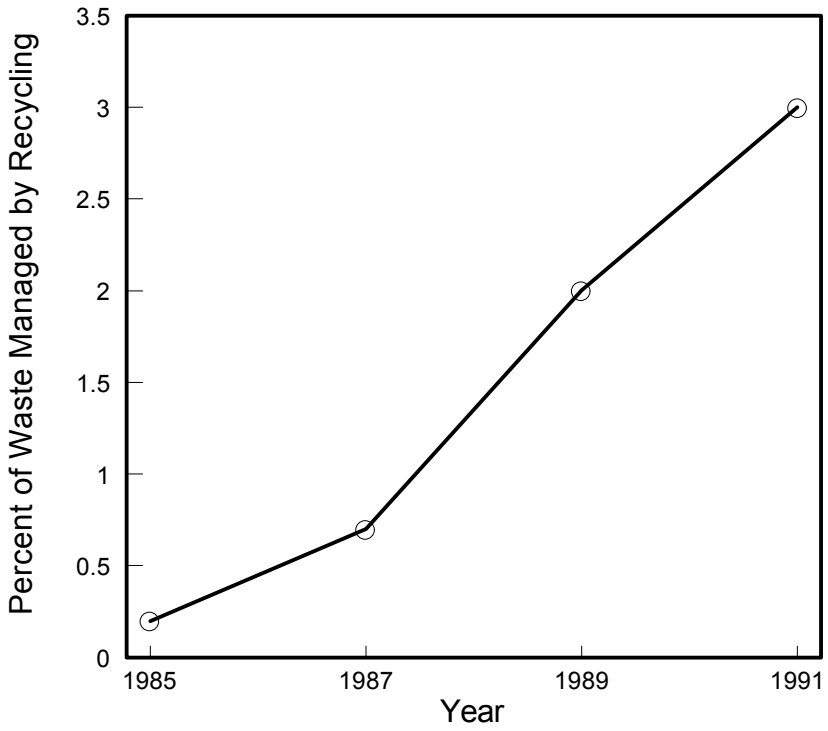
Data from the 1985 through 1991 BRS, displayed in Exhibit 2-5, show trends in the recovery/recycling of RCRA hazardous waste over time. The 1989 and 1991 numbers are considered more reliable than the earlier years because of quality assurance/quality control measures implemented by OSW. Unlike the other Subtitle C indicators presented in this chapter, this indicator is based on data for waste quantities managed rather than quantities generated, and includes both primary and secondary wastes.

The data indicate that the proportion of hazardous waste managed through recovery/recycling has increased steadily over time, from 0.2 percent in 1985 to 3 percent in 1991. As a percentage of overall waste managed, though, the proportion recovered is quite small. It is important to note that because many recycling units are exempt from RCRA permitting requirements, and therefore not included in these numbers, it is likely that a significantly larger proportion of hazardous waste is recycled than reflected here. As shown in indicator 3B, recycling rates are much higher for non-wastewaters than for wastewaters.

Exhibit 2-5.

Subtitle C Indicator No. 3A. Trends in the Recycling/Recovery of RCRA Hazardous Waste, 1985-1991*

Percentages Include Both Primary and Secondary Waste



Source: 1985 through 1991 Biennial Reporting System.

*RCRA permitted units only.

3B. Comparison of 1989 and 1991 Recycling/Recovery of Hazardous Wastewater and Non-wastewater

Exhibit 2-6 shows, for 1989 and 1991, the percentage of hazardous wastewater and non-wastewater that was managed by recovery/recycling. As the exhibit indicates, recycling/recovery of hazardous wastewater was a very small percentage of total hazardous wastewater management; however, between 1989 and 1991 the percentage did increase slightly to around 1 percent. In contrast, recycling/recovery of hazardous non-wastewater accounts for a large proportion of non-wastewater management, increasing from around 30 percent in 1989 to almost half of non-wastewater managed in 1991.

Subtitle D Indicators

1. Trends in Total Municipal Solid Waste Generation, 1960 to 1993

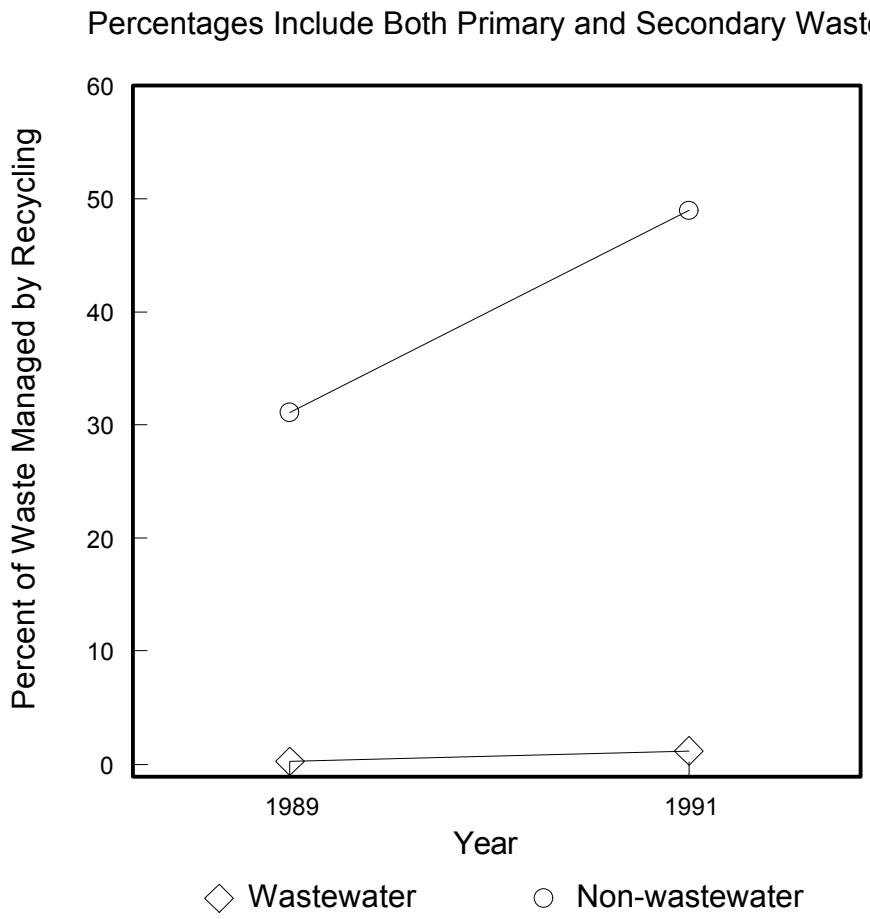
The nation's generation of municipal solid waste (MSW) has increased steadily over time, from 88 million tons in 1960 to 207 million tons in 1993 (Exhibit 2-7). Exhibit 2-7 shows that waste generation actually decreased slightly from 1990 to 1991, but increased in 1992 and 1993, continuing the upward trend. Factors that may contribute to increases in waste generation include increased population size and increased economic activity. Both population levels and economic activity levels (as indicated by Gross Domestic Product) correlate significantly with MSW generation (EPA, 1994).

2. Trends in Per Capita Municipal Solid Waste Generation, 1960 to 1993

To remove the population growth effect on MSW generation, it is useful to evaluate per capita generation. As illustrated in Exhibit 2-8 (EPA, 1994), per capita waste generation increased steadily from 1960 to 1990, but remained fairly level from 1990 to 1993. From 1960 to 1990, per capita MSW generation increased at a slower rate than total generation, indicating that past trends toward higher total MSW generation rates are attributable to population growth as well as increases in per capita waste generation. From 1990 to 1993, per capita waste generation increased only very slightly–from 4.35 to 4.39 pounds per person per day. This may be due, at least in part, to source reduction measures, particularly efforts to keep yard trimmings out of the waste stream by backyard composting and leaving grass clippings on lawns (EPA, 1994). EPA's current goal for per capita waste generation is 4.3 pounds per day (EPA, 1995).

Exhibit 2-6.

Subtitle C Indicator No. 3B. Comparison of 1989 and 1991 Recycling/ Recovery of Hazardous Wastewaster and Non-wastewater*

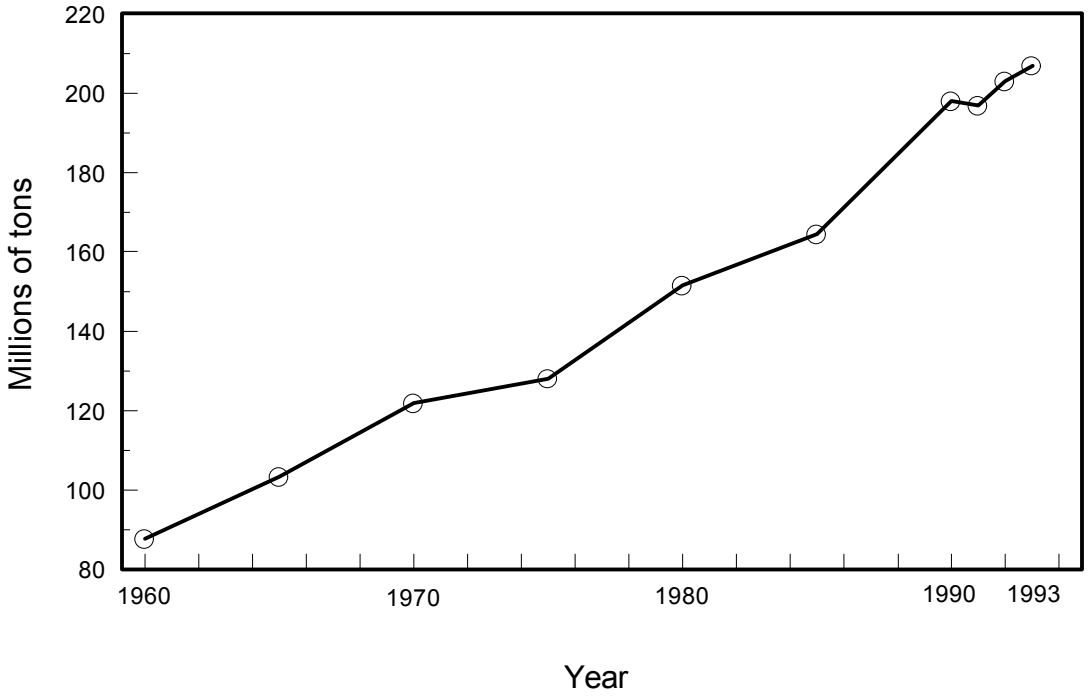


Source: 1989 and 1991 Biennial Reporting System.

*RCRA permitted units only.

Exhibit 2-7.

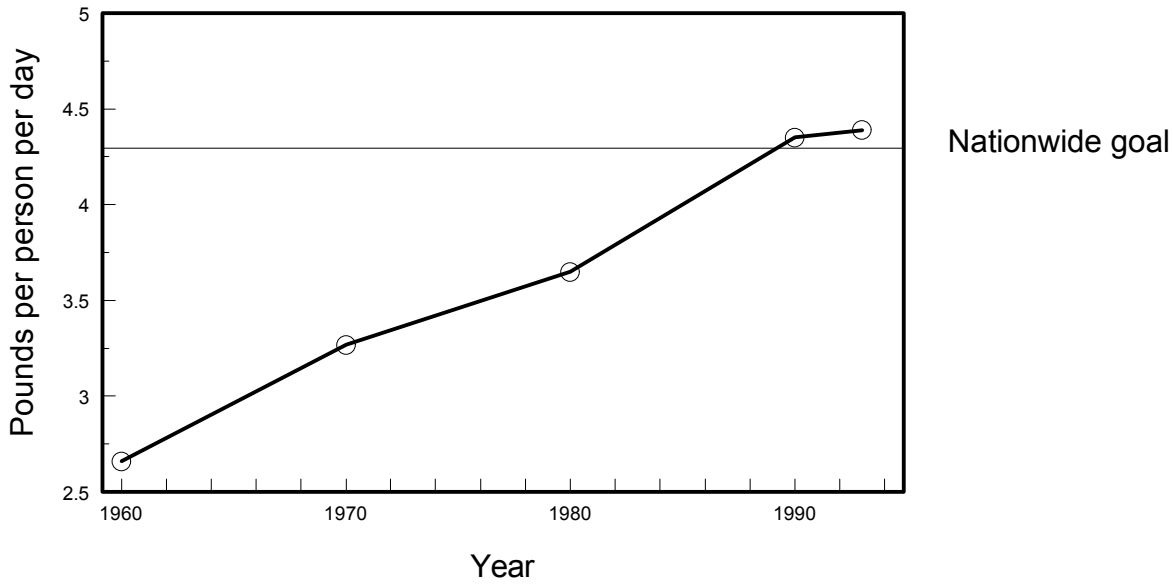
Subtitle D Indicator No. 1. Trends in Total Municipal Solid Waste Generation, 1960-1993



Sources: EPA, Characterization of Municipal Solid Waste in the United States: 1992 Update.
EPA, Characterization of Municipal Solid Waste in the United States: 1994 Update.

Exhibit 2-8.

Subtitle D Indicator No. 2. Trends in Per Capita Municipal Solid Waste Generation, 1960-1993



Source: EPA, Characterization of Municipal Solid Waste in the United States: 1994 Update.

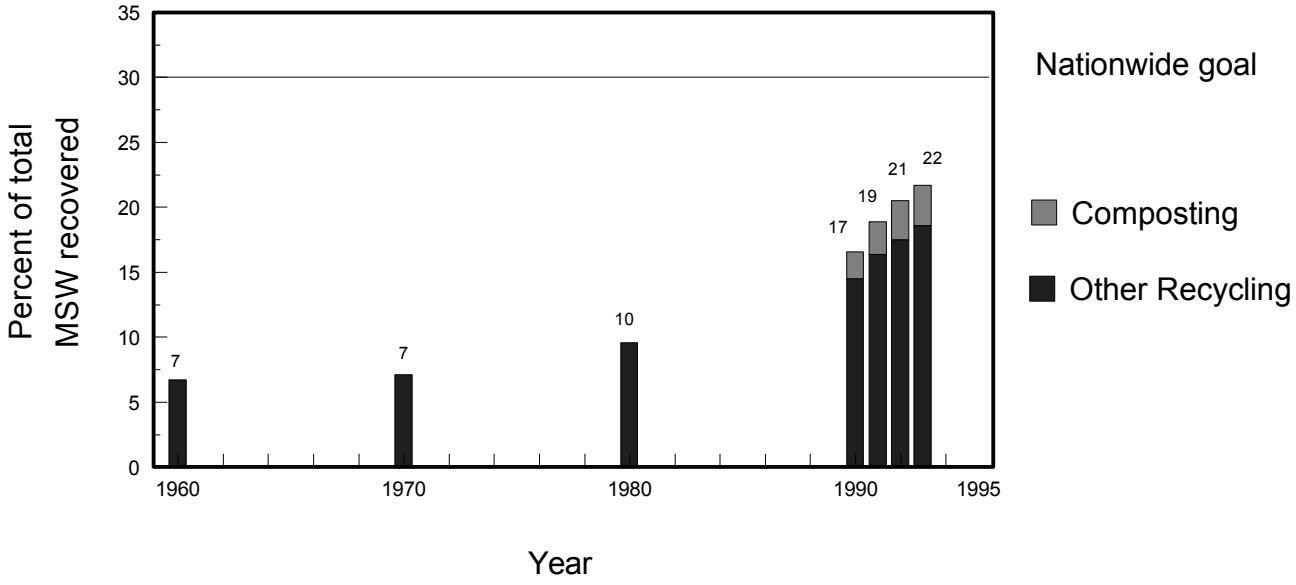
3. Trends in the Recovery of Municipal Solid Waste for Recycling (Including Composting), 1960 to 1993

The amount of waste materials recovered (through the collection of recyclables[4]) has increased steadily over time in the U.S. (Exhibit 2-9). Less than 7 percent of this country's waste was recovered in 1960, compared to 22 percent in 1993. EPA's current goal for the nation is 30 percent (EPA, 1995). From 1990 to 1993 the increase in materials recovery was particularly dramatic–from 38 million tons per year to 45 million tons per year. Materials recovered are comprised mainly of paper and paperboard (59 percent in 1993), yard trimmings (14 percent), metals (12 percent), and glass (8 percent) (EPA, 1994). While overall recovery of plastics for recycling is relatively small, recovery of some plastic containers (e.g., PET, HDPE) is steadily increasing.

[4] The recyclables measured here include only wastes that first enters the waste stream, and then are recycled or composted. Materials that are reused at home or yard trimmings that are backyard composted or grass clippings that are left on the lawn are not included.

Exhibit 2-9.

Subtitle D Indicator No. 3. Trends in the Recovery of Municipal Solid Waste for Recycling (Including Composting), 1960-1993



Source: EPA, Characterization of Municipal Solid Waste in the United States: 1994 Update.

Four safe management indicators are being reported in this chapter, two for hazardous wastes and two for municipal solid wastes.

Subtitle C Indicators:

- Subtitle C Indicator No. 1A. Quantities of Hazardous Waste Managed at Subtitle C Facilities in 1991, By Management Practice
- Subtitle C Indicator No. 1B. Comparison of Hazardous Waste Managed at Subtitle C Facilities in 1989 and 1991, By Management Practice
- Subtitle C Indicator No. 2A. Number of Class I Violations Found at the Last Inspection During 1990-1991, By Number of Facilities and Volume of Waste
- Subtitle C Indicator No. 2B. Comparison of Class I Violations Found at the Last Inspections in 1988-1989 and 1990-1991, By Percent of Facilities and Percent of Waste

Subtitle D Indicators:

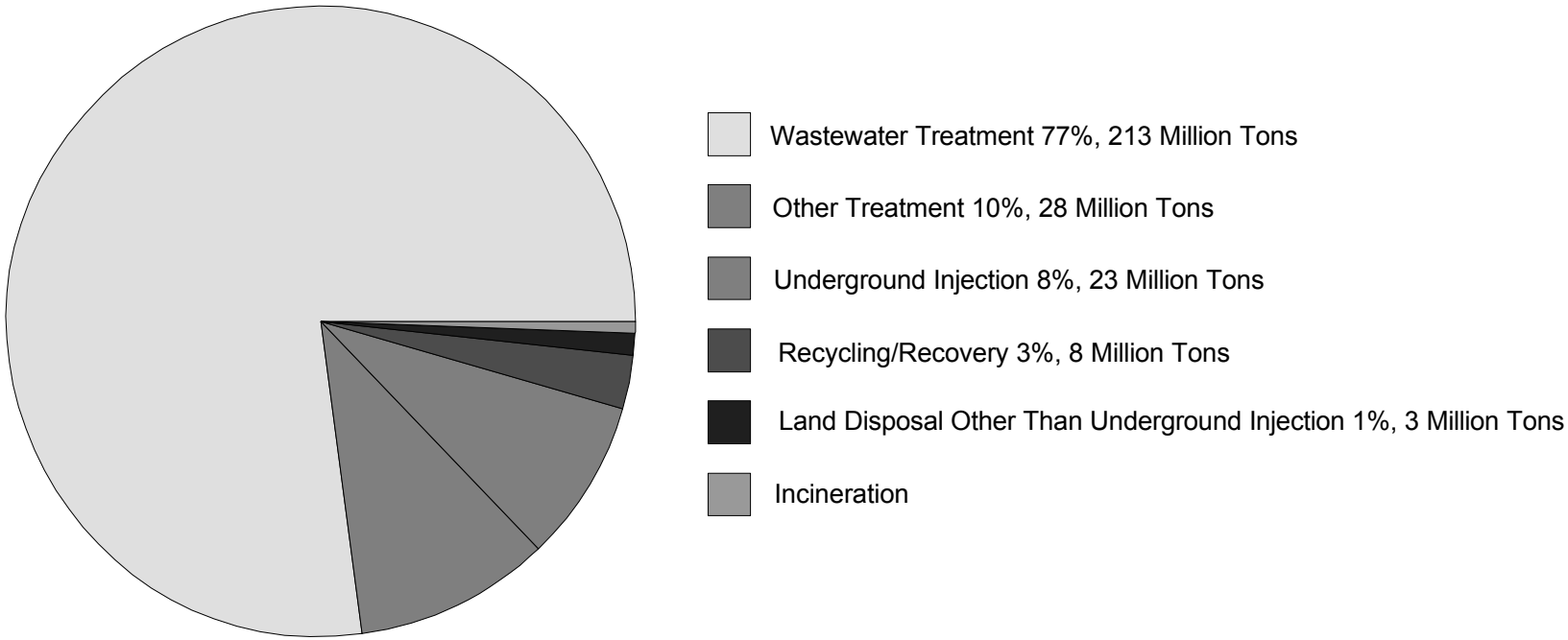
- Subtitle D Indicator No. 1. Municipal Solid Waste Management Trends, 1960 to 1993.
- Subtitle D Indicator No. 2. Trends in the Number of Household Hazardous Waste Collection Programs, 1980 to 1993

Subtitle C Indicators

1A. Quantities of Hazardous Waste Managed At Subtitle C Facilities in 1991, By Management Practice

Exhibit 3-1 shows the management practices used for 277 million tons of hazardous waste managed at Subtitle C treatment, storage, and disposal (TSD) facilities in 1991. The data were derived from the 1991 BRS Reporting Database. The quantity of waste reported as "managed" in this exhibit is greater than the amount reported as "generated" in Chapter 2 because the quantity managed includes both primary and secondary wastes. As in Chapter 2, this exhibit excludes CBI data and (to the extent permitted by the data

Exhibit 3-1
Subtitle C Indicator No. 1A. Quantities of Hazardous Waste Managed at Subtitle C Facilities in 1991, By Management Practice



Total Hazardous Waste Managed = 277 Million Tons

Source: 1991 Biennial Reporting System

submissions) hazardous wastes managed exclusively in units exempt from RCRA permitting requirements. Such wastes are mostly wastewaters treated in tanks and discharged to a Publicly-Owned Treatment Works (POTW) or to surface water under a National Pollutant Discharge Elimination System (NPDES) permit. In cases where it was difficult to determine from the information submitted whether the waste was managed in a RCRA-regulated or RCRA-exempt process, the waste was assumed to be RCRA-regulated.

As shown in Exhibit 3-1, the majority of wastes managed in 1991 (77 percent) were treated using wastewater treatment processes. The top five wastewater treatment systems were:

- Biological treatment (approximately 119 million tons, or 56 percent of the waste managed in wastewater treatment systems).
- Chemical precipitation in combination with biological treatment (about 60 million tons, or 28 percent).
- Other organic/inorganic treatment (about 14 million tons, or six percent).
- Unknown aqueous organic treatment (about 8 million tons, or four percent).
- Chemical precipitation (approximately 5 million tons, or two percent).

Other management types used in 1991 were:

- "Other Treatment" accounted for 10 percent of wastes managed in 1991. This category includes processes such as neutralization, sludge dewatering, and stabilization.
- Recovery and recycling accounted for about three percent (7.6 million tons) of the hazardous waste managed in 1991. The top two recovery categories were
  - Solvents recovery (3.6 million tons); and
  - Energy recovery (1.5 million tons).
- Over nine percent of hazardous wastes (26 million tons) were land disposed in 1991. Most of this waste (23 million tons, or eight percent) was disposed in underground injection wells, while the other 3 million tons (one percent) were disposed in landfills, land application units, and surface impoundments.[2]
- About 1.7 million tons of waste (less than one percent) were managed by incineration in 1991. The majority of incinerated wastes (about 1.4 million tons) were liquids.

[2] In the BRS, the "surface impoundment" system code applies only to surface impoundments that will eventually be closed as landfills, i.e., with accumulated sludges in place. Wastes that are placed in surface impoundments that are dredged periodically and that remove wastes before closing are not included among the quantities reported as land disposed. These wastes are typically reported under the wastewater treatment system codes.

1B. Comparison of Hazardous Waste Managed at Subtitle C Facilities in 1989 and 1991, By Management Practice

Exhibit 3-2 compares the quantity of hazardous waste managed in 1989 with the quantity managed in 1991. The exhibit also shows, for 1991, the proportion of total waste managed that is newly regulated hazardous waste. See Appendix D for a discussion of newly regulated wastes, i.e., wastes that became subject to regulation under RCRA Subtitle C between 1989 and 1991.

The total amount of hazardous waste managed in 1991 (277 million tons) was 57 million tons more than the 220 million tons managed in 1989, representing an increase of 25 percent. Newly regulated waste accounted for 52 percent of total waste managed.

In analyzing the changes between waste managed in 1989 and previously regulated and newly regulated waste managed in 1991, by management type, the data indicate the following:

- Wastewater treatment increased 38 percent from 154 million tons to 213 million tons. This increase was due to management of newly regulated wastewaters, which accounted for 62 percent of the waste managed by wastewater treatment. If newly regulated waste was not included, wastewater treatment actually would have decreased 48 percent. Nearly 90 percent of newly regulated waste managed by wastewater treatment was managed by aqueous organic treatment. Waste managed by this treatment type increased more than 100 percent, 88 percent of which was newly regulated.

- The category "Other Treatment" increased slightly (two percent) from 27 million tons to 28 million tons. Newly regulated waste accounted for 29 percent of waste managed in this category. If newly regulated wastes were not included, management in Other Treatment would actually have decreased 28 percent.

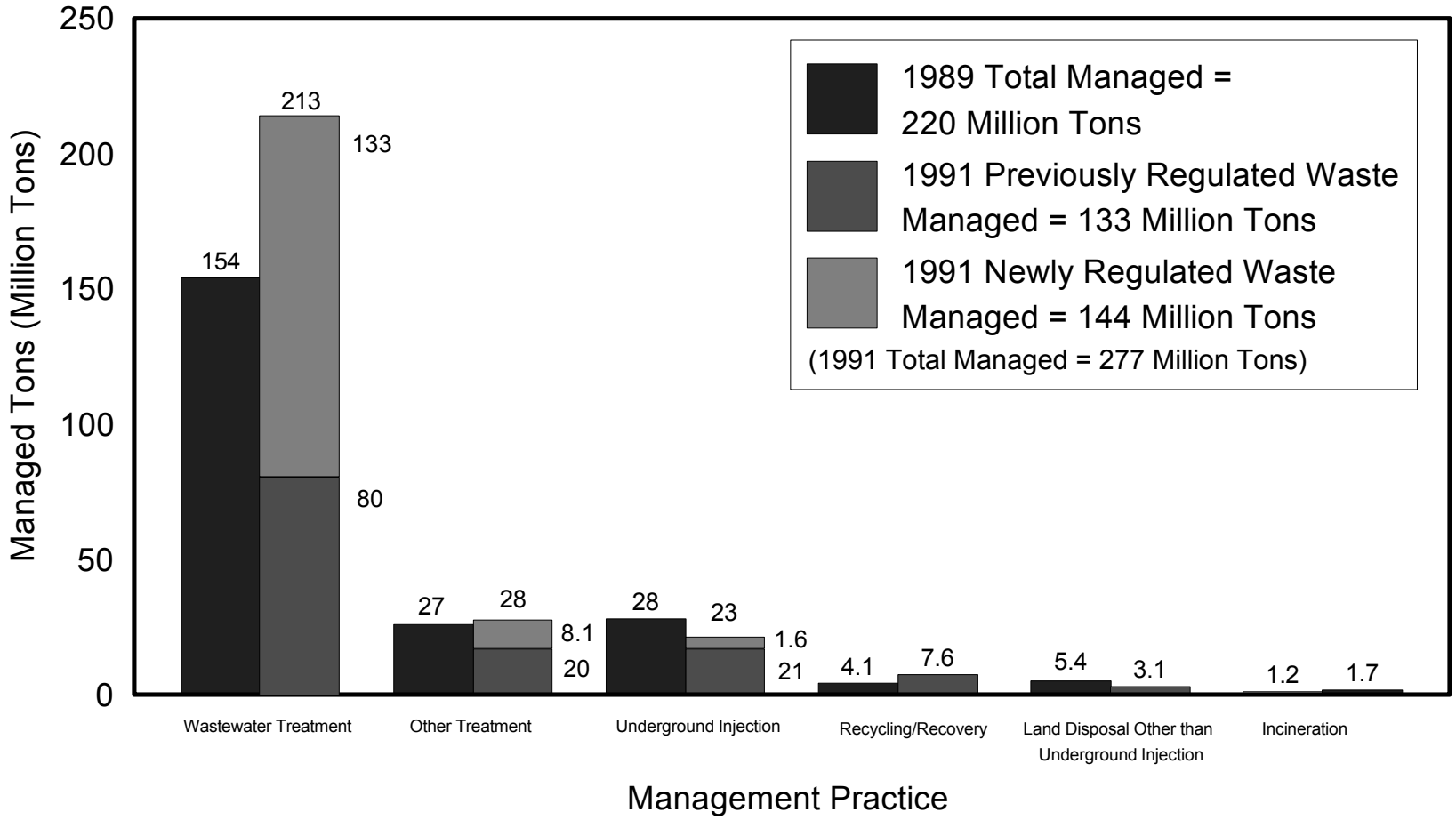
- Land disposal other than underground injection wells decreased by 43 percent from 5.4 million tons to 3.1 million tons. Newly regulated waste accounted for 32 percent of this category. Without including newly regulated waste, management by land disposal would have decreased 61 percent.

The remaining types of management were not significantly affected by the management of newly regulated waste:

- Recycling/recovery increased 85 percent from 4.1 million tons to 7.6 million tons. Only 2.9 percent of this quantity was newly regulated waste.

  – Solvents recovery increased 780 percent to 3.6 million tons; and
  – Metals recovery decreased 44 percent to 760,000 tons.

Exhibit 3-2
Subtitle C Indicator No. 1B. Comparison of Hazardous Waste Managed at Subtitle C Facilities in 1989 and 1991, By Management Practice



Source: 1989 and 1991 Biennial Reporting Systems

Note: The 1989 data presented in this exhibit are different from the 1989 data presented in the April 1993 RCRA Environmental Indicators report. The data presented here are more accurate due to additional quality assurance/quality control procedures performed on the database subsequent to the previous report. In addition, this exhibit excludes CBI data, which were included in the earlier report.

However, because many recycling units are exempt from RCRA permitting requirements, and therefore not included in this report, it is possible that a larger proportion of newly regulated waste is recycled in exempt units.

- Incineration increased by 42 percent from 1.2 million tons to 1.7 million tons. Only four percent of this waste was newly regulated.

- Underground injection decreased 18 percent from 28 million tons to 23 million tons. Newly regulated wastes accounted for six percent of the waste managed in this category.

2A. Number of Class I Violations Found at the Last Inspection During 1990-1991, by Number of Facilities and Volume of Waste

The RCRA program conducts inspections of hazardous waste generators, transporters, and treatment, storage, and disposal facilities (TSDFs) to determine whether they are in compliance with applicable regulations. EPA tracks the occurrence and severity of violations discovered during these inspections and uses this information for enforcement purposes.

The most serious violations are called Class I. The definition of a Class I violation has evolved over time, but in 1989 (the first year for reporting this indicator) a Class I violation was defined as "A violation that results in a failure to: assure that hazardous waste is destined for and delivered to authorized TSDFs; prevent releases of hazardous waste or constituents, both during the active and any applicable post-closure periods of the facility operation where appropriate; assure early detection of such a release; or perform emergency clean-up operation or other corrective action for release."[3]

Class I violations can be physical or administrative. While any Class I violation could result in a potentially environmentally threatening situation[4], the occurrence of such a violation does not necessarily mean that waste is not being managed safely. For this indicator, the absence of Class I violations at an inspected treatment, storage, and disposal facility (TSDF) is being used to indicate that the facility's wastes are being managed "safely." There are several important caveats associated with using compliance information in this way; they are listed at the end of this section.

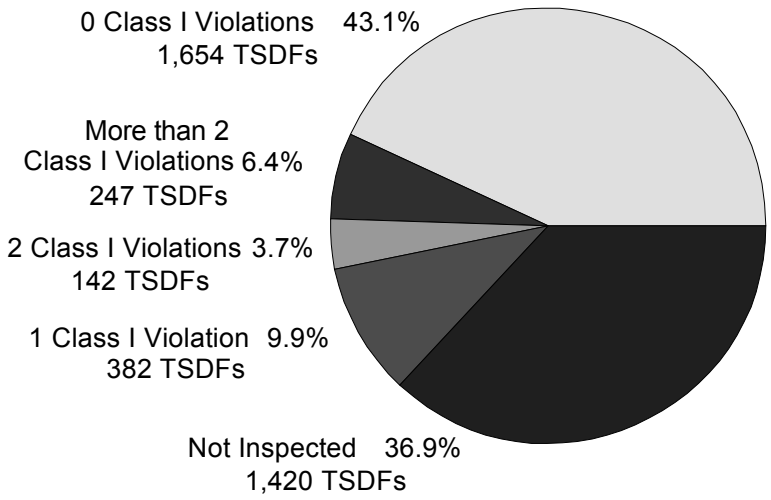
Exhibit 3-3 presents information on the occurrence of Class I violations at RCRA hazardous waste TSDFs. Data on waste quantities were derived from the 1991 BRS and include all hazardous waste managed in units subject to RCRA permitting. Data on the number of Class I violations were drawn from the results of facility inspections recorded in RCRIS for fiscal years 1990 to 1991. Thus, the universe of facilities shown

[3] U.S. EPA. Enforcement Response Policy. December 1987.

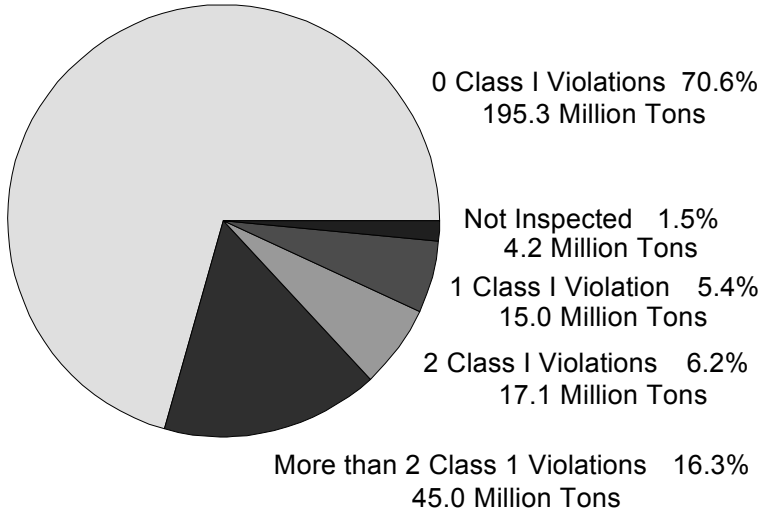
[4] Even an administrative violation can be environmentally threatening, for example, if it precludes an inspector from determining whether a facility is in compliance with permit conditions.

Exhibit 3-3.

Subtitle C Indicator No. 2A. Number of Class I Violations Found at the Last Inspection During 1990-1991, By Number of Facilities and Volume of Waste



Number of TSDFs
(3,845 Total)



Tons of Waste Managed at TSDFs
(277 Million Tons Total)

Universe is limited to TSDFs that submitted a 1991 Biennial Report Form.
Some TSDFs are not included because of Confidential Business Information (CBI).

Sources: 1991 Biennial Reporting System
Resource Conversation and Recovery Information System (RCRIS), 1994.

in Exhibit 3-3 is limited to TSDFs that submitted a 1991 Biennial Report form. The classification of facilities as TSDFs is based on 1991 BRS data.

Exhibit 3-3 shows the number and percent of TSDFs that were found to have zero, one, two, or more than two Class I violations during the last inspection. It is based on 3,845 TSDFs that submitted a Biennial Report form for 1991 (some TSDFs that submitted forms are not included because they contain confidential business information [CBI]). Exhibit 3-3 also shows the quantity and proportion of waste managed by these facilities.

Of the 2,425 inspected TSDFs (that submitted a 1991 Biennial Report Form)[5], 1,654 TSDFs had no Class I violations and managed 195 million tons (over 70 percent) of the hazardous waste. Class I violations were found at 771 facilities that managed 48 million tons (28 percent) of the waste. The data suggest that as of 1991, most TSDFs were in compliance with RCRA regulations and most RCRA hazardous waste was being managed safely. It is important, however, to understand three limitations associated with this indicator:

- Only inspected facilities have information on the number of violations. There is no way to determine which uninspected facilities were managing wastes safely in 1991.

- The occurrence of a Class I violation does not necessarily mean that a facility is posing actual threats to the environment; the lack of compliance only suggests the potential to do so.

- Facilities not having Class I violations entered in the RCRIS database for fiscal year 1990 to 1991 may pose a threat to the environment through unidentified releases, or from outstanding violations from previous years.

2B. Comparison of Class I Violations Found at the Last Inspection During 1988-1989 and 1990-1991, By Percent of Facilities and Percent of Waste

Exhibits 3-4a and 3-4b compare the incidence of Class I violations found at the last inspection during 1988-1989 with the incidence of violations in 1990-1991, first by percent of facilities (Exhibit 3-4a) and then by percent of waste managed at those facilities (Exhibit 3-4b).

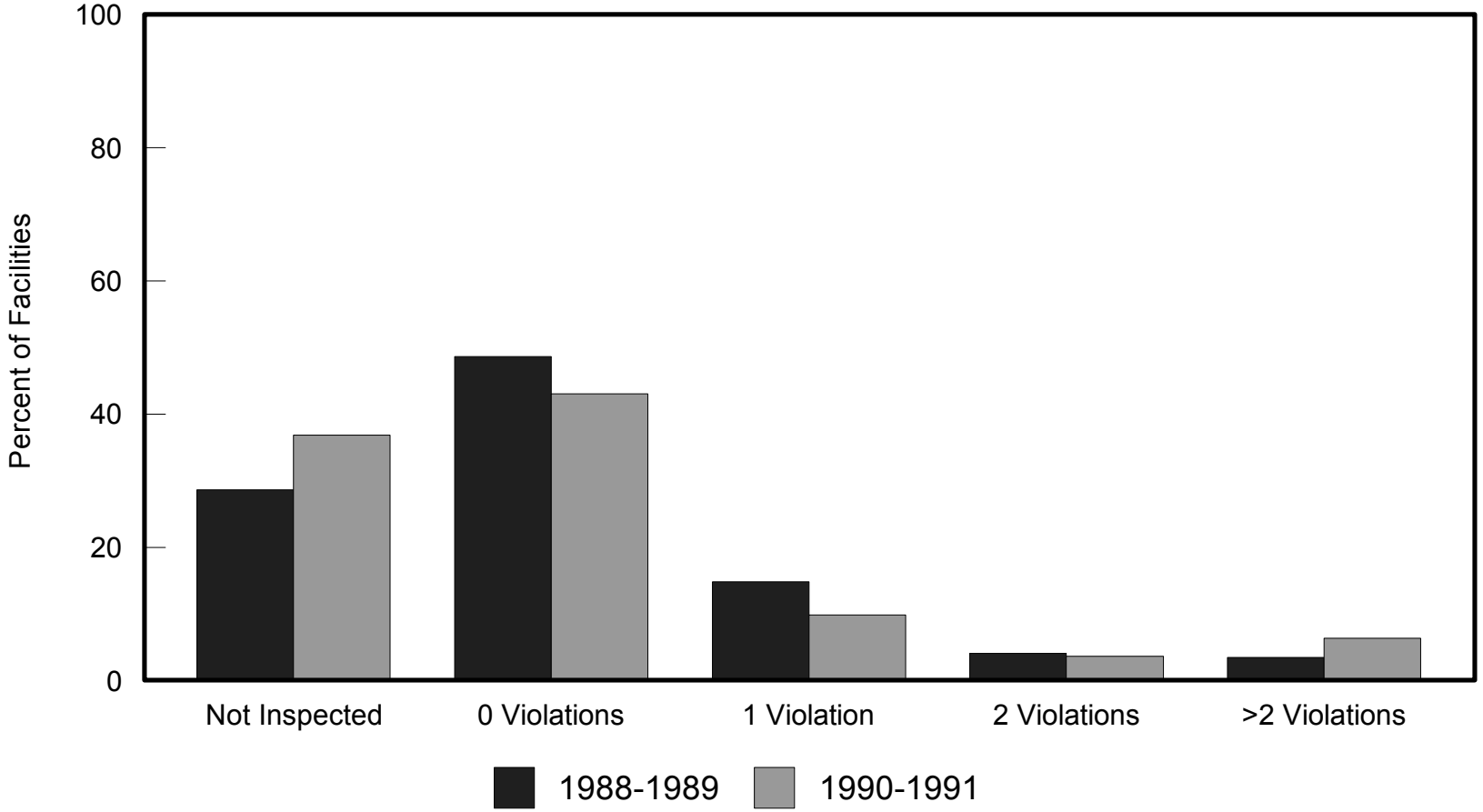
Exhibit 3-4a shows that the proportion of facilities with no violations is somewhat smaller during the more recent period; as a percent of the number of facilities inspected, however, the number without violations has remained essentially constant (68 percent). There has been a shift in the number of Class I violations found, however. While fewer facilities were found to have one Class I violation during the 1990-1991 inspection period, the proportion with more than two Class I violations has increased.

Exhibit 3-4b tells a somewhat similar story. The percent of waste managed at facilities without any Class I violations was slightly higher during the 1990-1991 inspection period.

[5]Note that while only 63 percent of the TSDFs that submitted a 1991 Biennial Report Form were inspected, the inspected facilities managed over 98 percent of the hazardous waste in 1991.

Exhibit 3-4a.

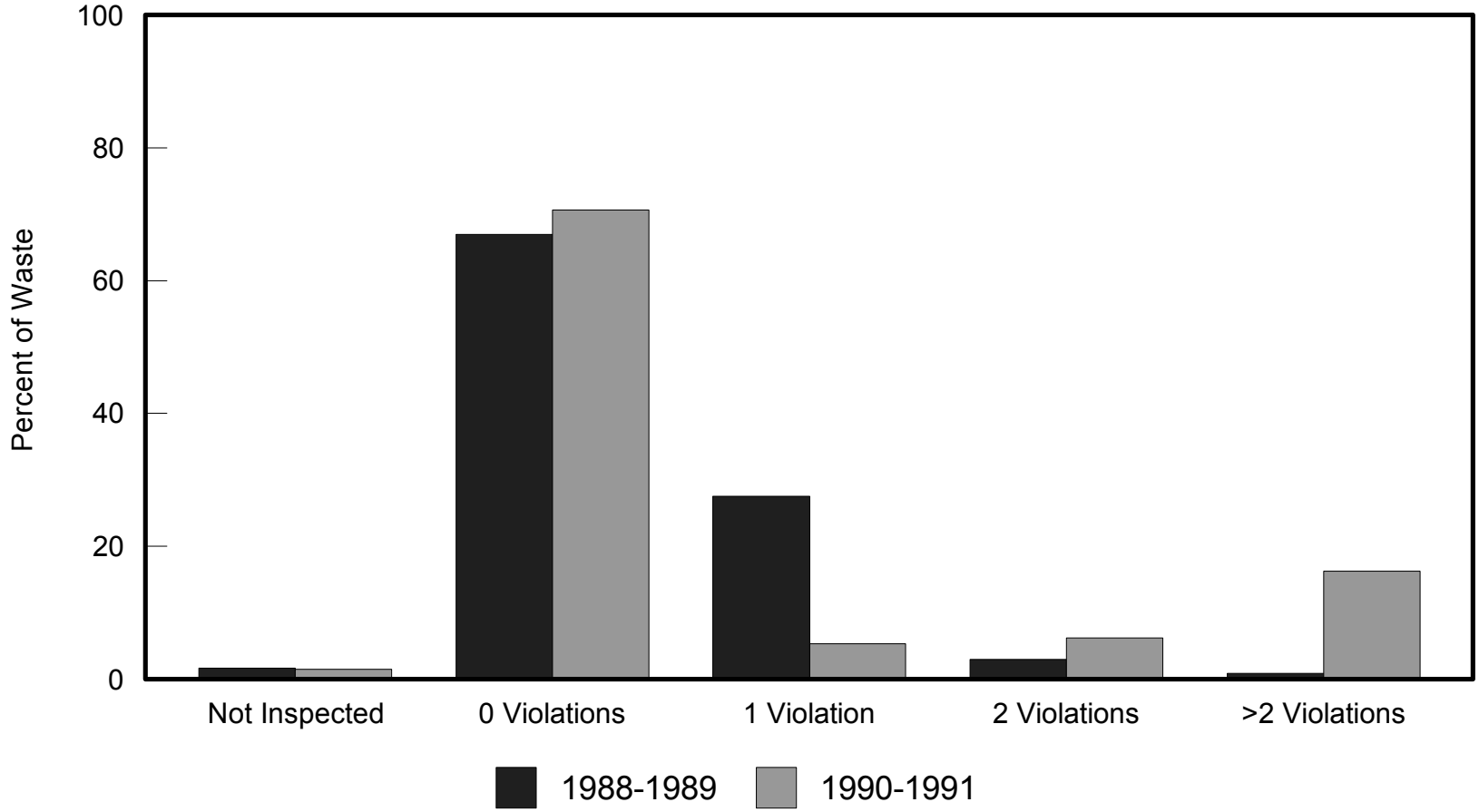
Subtitle C Indicator No. 2B. Comparison of Class I Violations Found At The Last Inspection During 1988-1989 and 1990-1991, By Percent of Facilities



Sources: 1991 Biennial Reporting System
Resource Conservation and Recovery Information System (RCRIS), 1994.

Exhibit 3-4b.

Subtitle C Indicator No. 2B. Comparison of Class I Violation Found At The Last Inspection During 1988-1989 and 1990-1991, By Percent of Waste



Sources: 1991 Biennial Reporting System
Resource Conservation and Recovery Information System (RCRIS), 1994.

However, in 1990-1991, a higher proportion of waste was managed at facilities with two or more Class I violations. In the 1990-1991 inspection period, the percent of waste managed at facilities with only one Class I violation decreased substantially; the percent managed at facilities with two violations increased, and the percent managed at facilities with more than two violations increased significantly.

Subtitle D Indicators

1. Municipal Solid Waste Management Trends, 1960 - 1993

While generation rates of MSW have been increasing over time, trends in the proportion managed by different methods have varied over the past 33 years (Exhibit 3-5). The proportion of MSW incinerated declined from 1960 through 1985, but began rising thereafter as incinerators were built to recover energy and comply with air pollution standards. The proportion landfilled increased throughout that time, but began to decrease in the mid-1980s as combustion and recycling increased in popularity.

By 1990, 67 percent of the waste stream was managed by landfilling, 17 percent by recovery, and 16 percent by combustion. For the next three years (1990 to 1993), MSW combustion neither increased nor decreased, remaining steady at around 16 percent of the total waste stream. The proportion of waste landfilled continued to decline during this three-year period, but at a slower rate than during the previous five years. This decrease was due almost entirely to an increase in recycling. Recycling, including composting, as a percentage of total MSW continued to increase at an accelerating rate from 1990 (17 percent) to 1993 (22 percent). Of the 4.4 pounds of MSW generated daily per capita in 1993, only 3.4 pounds were discarded because of recycling (EPA, 1994).

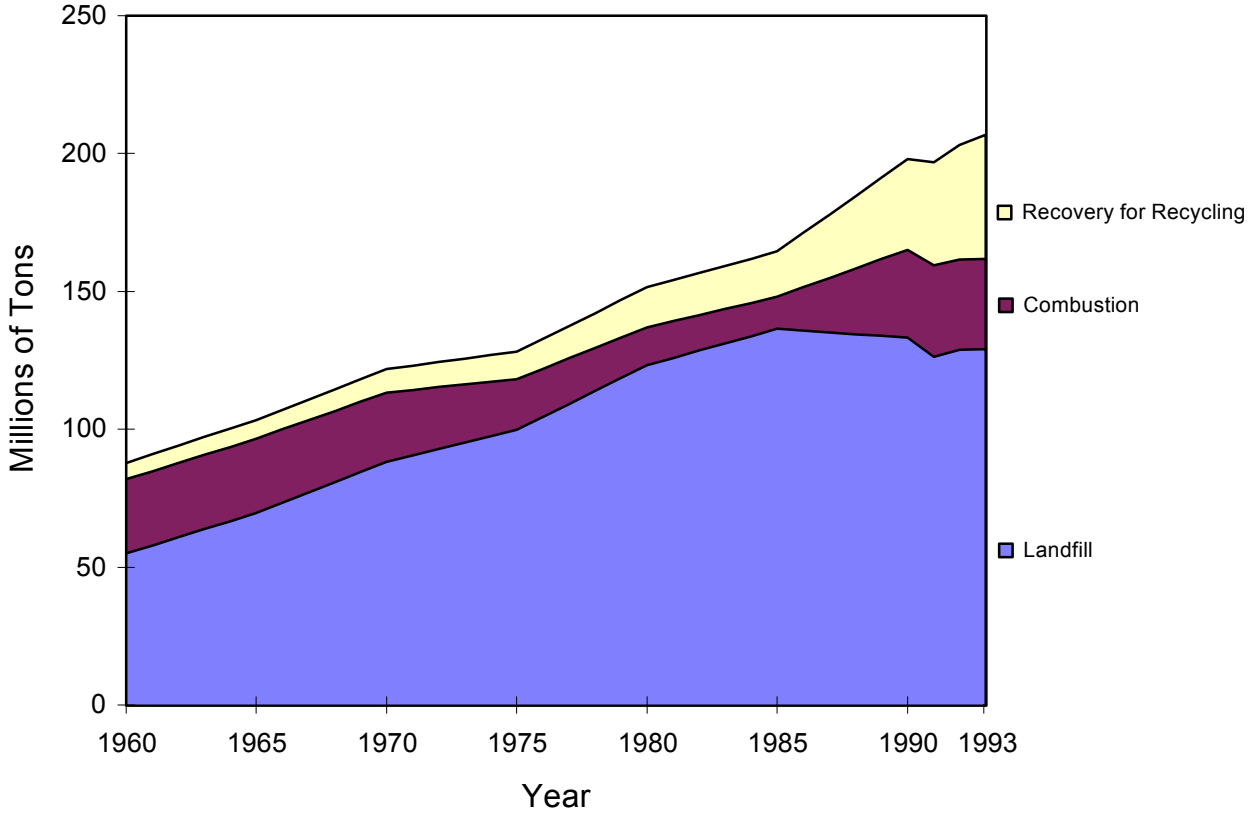
2. Trends in the Number of Household Hazardous Waste Collection Programs, 1980 to 1993

An increase in household hazardous waste (HHW) collection programs can be interpreted as an indicator of increased interest by local communities in reducing the toxicity of their municipal solid waste. As discussed in the April 1993 Environmental Indicators Report, the number of HHW collection programs reported by the Waste Watch Center[6] grew dramatically from 1980 to 1900, from 2 programs in 1980 to 859 in 1990 (Exhibit 3-6a). A drop in the number of programs from 1990 to 1991 was the result of communities switching from a few one-day collection programs a year to permanent facilities. By 1992, the total number of programs had risen again, followed by a sharp increase in 1993. As Exhibit 3-6b illustrates, the number of permanent facilities has increased more and more rapidly during the last 13 years, reaching 172 facilities in 1993.

[6] The Waste Watch Center is a non-profit organization devoted to educational projects in the areas of solid, hazardous, and household hazardous waste management; reduction, reuse, and recycling; and pollution prevention. EPA provided funding to the Waste Watch Center for the collection of the information that is presented in this report.

Exhibit 3-5.

Subtitle D Indicator No. 1. Municipal Solid Waste Management Trends, 1960-1993

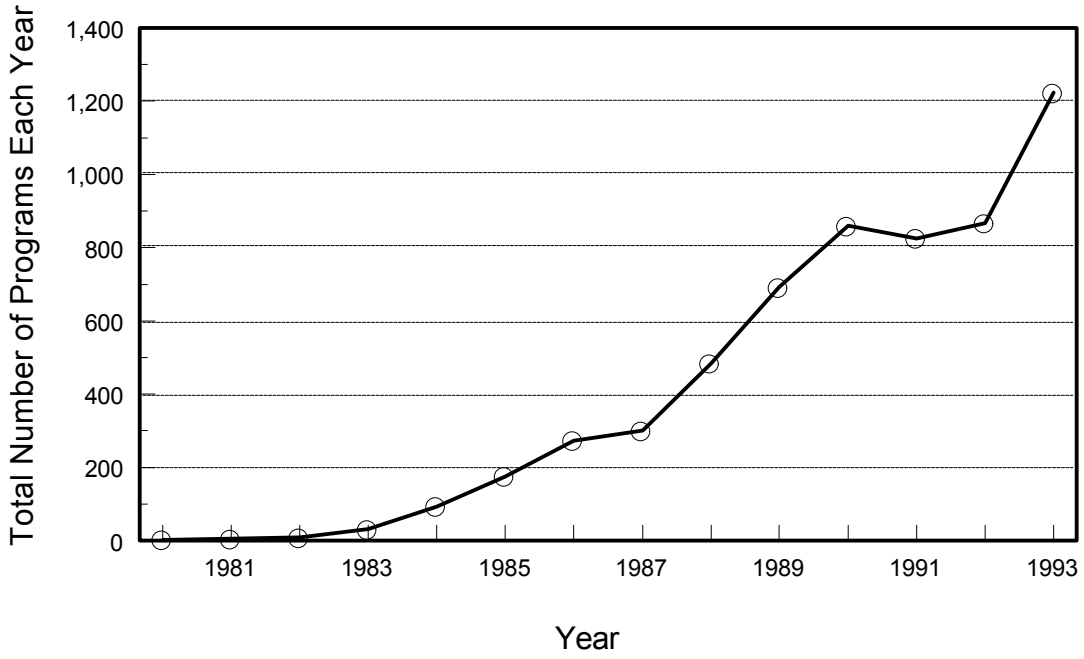


Sources: EPA, Characterization of Municipal Solid Waste in the United States: 1992 Update.
EPA, Characterization of Municipal Solid Waste in the United States: 1994 Update.

Exhibit 3-6a.

Subtitle D Indicator No. 2. Trends in the Number of Household Hazardous Waste Collection Programs, 1980 to 1993

Includes one-day events and permanent facilities

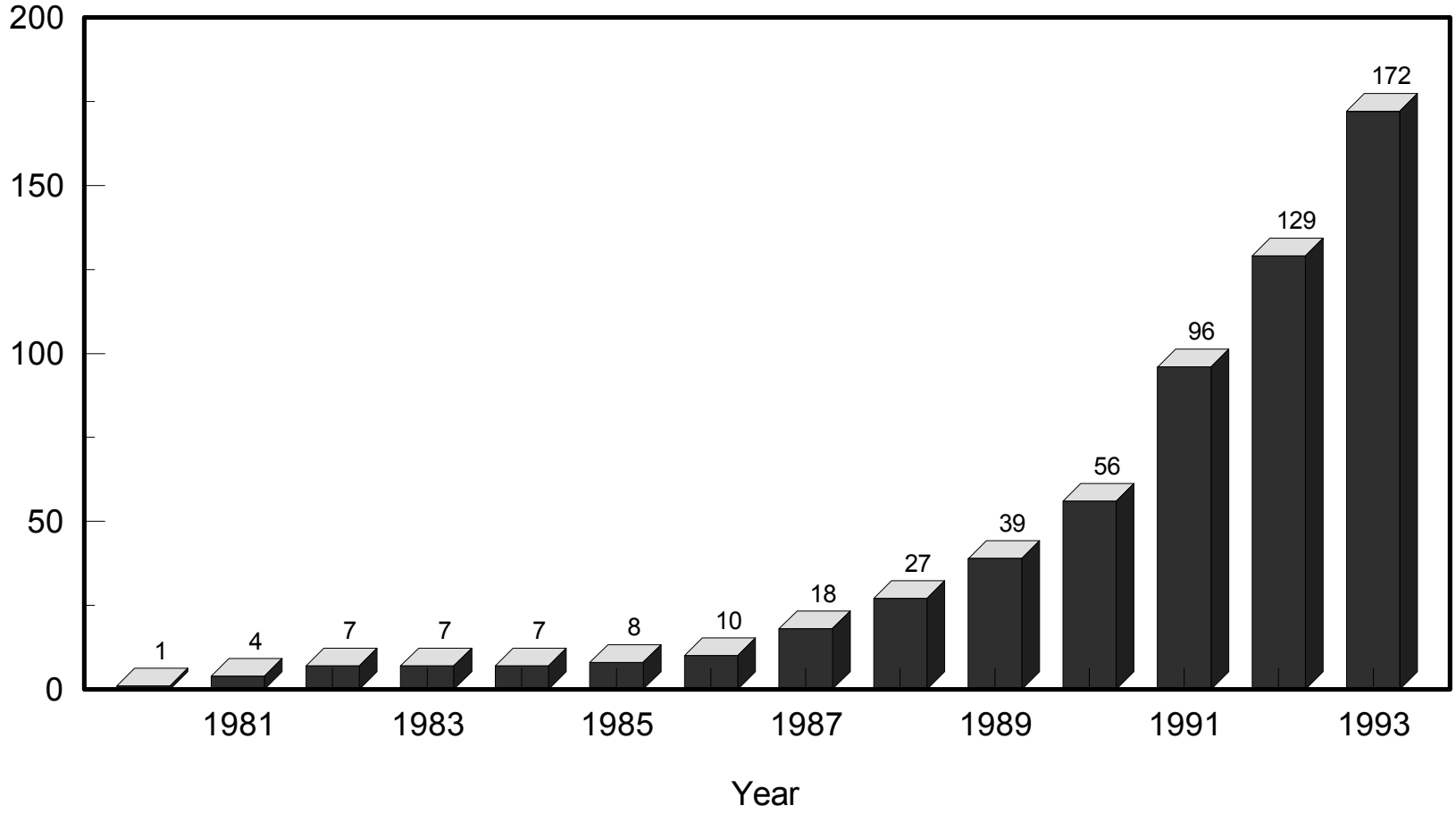


Source: Waste Watch Center, December 1993.

Exhibit 3-6b.

Subtitle D Indicator No. 2 (cont). Trends in the Number of Household Hazardous Waste Collection Programs, 1980-1993

Includes permanent facilities only



Programs are included only during year of operation.
Source: Waste Watch Center, December 1993.

Two indicators are being reported for corrective action:

- Subtitle C Indicator No. 1A. Status of Subtitle C Facilities in the Corrective Action Program
- Subtitle C Indicator No. 1B. Status of Subtitle C Facilities in the Corrective Action Program
- Subtitle C Indicator No. 2. Number of Subtitle C Facilities Conducting Investigations and Controlling Releases, by Priority Ranking

In addition, two new corrective action Subtitle C indicators have been developed and are expected to be reported by the end of FY 1997:

- Subtitle C Indicator No. 3. Number of Determinations of Human Exposures Controlled at RCRA Facilities.
- Subtitle C Indicator No. 4. Number of Determinations of Groundwater Releases Controlled at RCRA Facilities.

1. Status of Subtitle C Facilities in the Corrective Action Program

Exhibit 4-1 shows the 1995 status of RCRA TSDFs in the Subtitle C corrective action program. It is based on data from RCRIS (September 19, 1995) for all 56 States and territories. Three general stages of the corrective action process are shown:

i. Assessments: The RCRA Facility Assessment (RFA) is a general assessment of the site and an important step in identifying potential problems (e.g., contaminant releases). EPA (along with States and territories) has completed RFAs for all facilities reported in this category.

ii. Investigations: The RCRA Facility Investigation (RFI) is a more detailed study of sites that may be of concern, and the Corrective Measures Study (CMS) is a study of actions that may be taken to respond to environmental problems identified at the site. Facilities placed in this category have begun or completed an RFI or a CMS.

iii. Remedial Actions to Control Releases: Facilities placed in this category have initiated or completed remedial actions to address environmental problems. These actions include

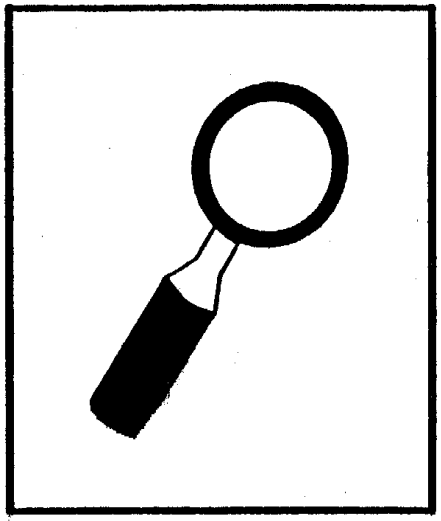
Exhibit 4-1.

Subtitle C Indicator No. 1A. Status of Subtitle C Facilities

In the Corrective Action Program

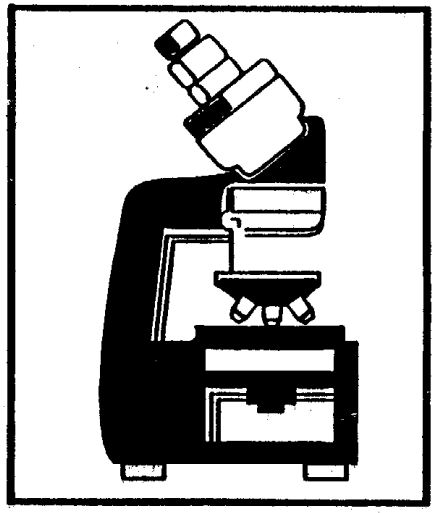
Program Inception Through FY 1994

Assessments



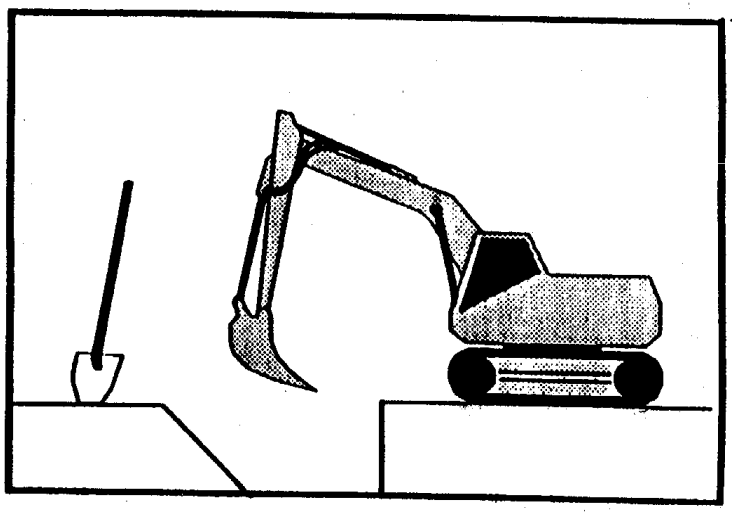
2,864 Facilities of a Total 3,853 Facilities Have Been Assessed (74%)

Investigations



43% of Facilities Assessed (32% of the Total) Have Begun or Completed Investigation (1,235 Facilities)

Controlling Contaminant Releases



19% of Facilities Assessed (14% of the Total) Are Controlling Contaminant Releases (539 Facilities)

Facilities include only Subtitle C treatment, storage, and disposal facilities (TSDFs).

Source: Resource Conversation and Recovery Information System (RCRIS), National Oversight Database, September 19, 1995.

stabilization measures (near-term risk reduction actions typically taken in the early phases of the corrective action process) and long-term cleanup activities.

Of the 3,853 TSDFs subject to Subtitle C corrective action at the end of FY 1994,[1] EPA has already completed RFAs (i.e., has assessed problems) at 74 percent (2,864 facilities).[2] EPA has already begun or completed further investigation at 1,235 facilities, or 43 percent of those assessed. This shows significant progress since 1992, when investigations had been begun or completed for only 1,052 facilities. In addition, 539 TSDFs have taken stabilization or cleanup actions in response to environmental problems, considerably more than in 1992 (304 facilities).

Exhibit 4-2 shows the trends in the number of RCRA facilities that have completed or begun (1) investigations or (2) remedial actions to control contaminant releases (two stages of the corrective action process defined above) for fiscal year 1990 to fiscal year 1994. The exhibit is based on September 19, 1995 RCRIS data for all 56 states and territories. The exhibit indicates that the number of facilities with investigations begun or completed has increased from 798 facilities by fiscal year 1990 to 1,235 facilities by fiscal year 1994. The number of facilities that have begun or completed remedial actions has also increased, from 215 facilities by fiscal year 1990 to 539 facilities by fiscal year 1994.

2. Number of Subtitle C Facilities Conducting Investigations and Controlling Releases, By Priority Ranking

A fundamental strategy of the Subtitle C corrective action program is to address sites with the greatest environmental and health risks first. The National Corrective Action Prioritization System (NCAPS) was developed in 1991 to help the Agency prioritize corrective action at RCRA TSDFs. Using NCAPS, EPA "scores" facilities based on environmental and health risks and ranks facilities as high, medium, or low priority based on these scores.[3]

Exhibit 4-3 shows the priority rankings of the 3,853 TSDFs subject to RCRA corrective action at the end of FY 1994. This exhibit is based on September 19, 1995 RCRIS data and covers all 56 States and territories. EPA has made substantial progress in assigning priority rankings to facilities in the last two years; rankings have been assigned to 3,604 facilities, compared to 2,637 in 1992. About 41 percent of TSDFs (1,561 facilities) have been assigned high priority, 29 percent (1,110 facilities) medium priority, and 24 percent (933 facilities) low priority.

---

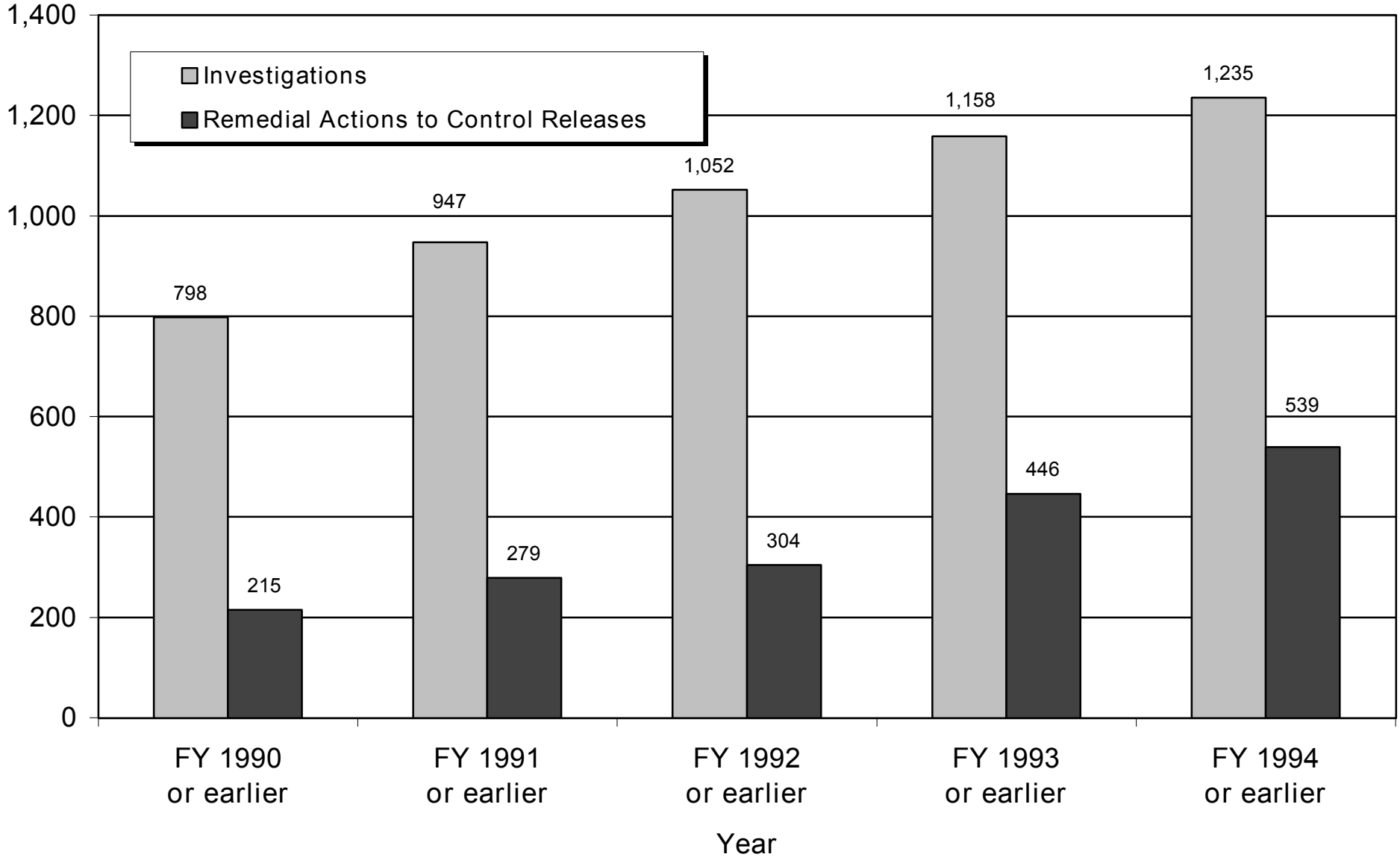
[1]The September 19, 1995 RCRIS data reports a lower number of RCRA TSDFs subject to Subtitle C corrective action (3,853) than reported for 1992 in the April 1993 Environmental Indicators report (4,218). This is due to quality control procedures performed on RCRIS subsequent to the previous report.

[2] This is smaller than the number discussed in the 1993 Environmental Indicators report (3,519 of 4,218 facilities, or 83 percent) because the earlier report included assessments performed under the Superfund program.

[3] NCAPS ranking is a separate process from the RCRA Facility Assessment process described in corrective action indicator no. 1.

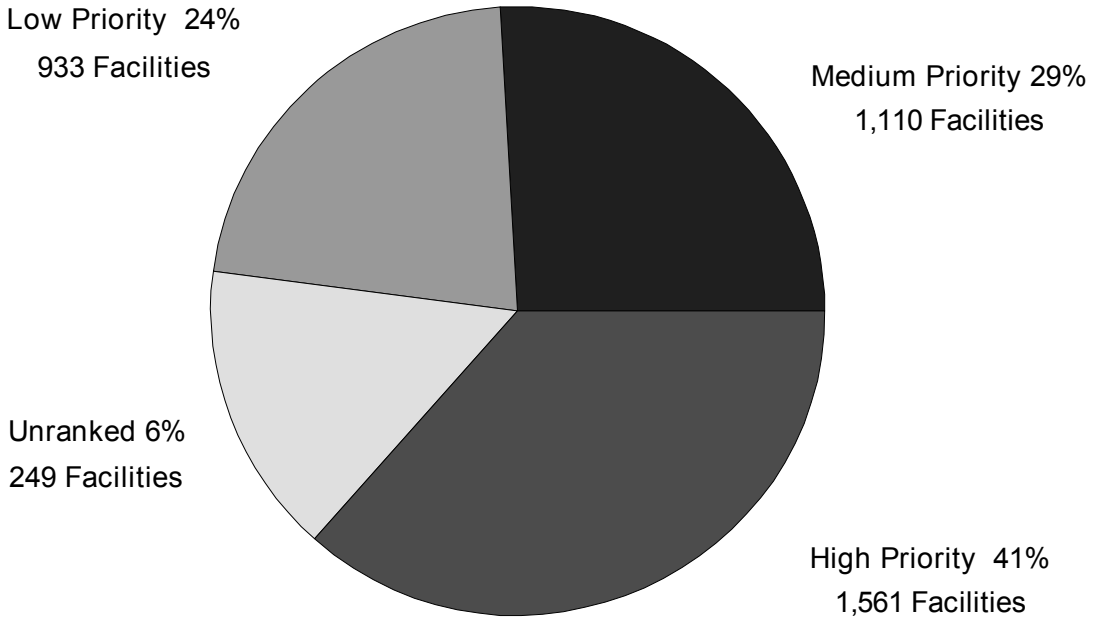
Exhibit 4-2.

Subtitle C Indicator No. 1B (Cont.) Status of Subtitle C Facilities in Corrective Action Program



Source: Resource Conservation and Recovery Information System (RCRIS), September 19, 1995.

Exhibit 4-3.
Priority Rankings of Subtitle C Facilities
3,853 Facilities Total



Facilities include only Subtitle C treatment, storage, and disposal facilities (TSDFs).
"Unranked" also includes 10 facilities whose ranking is unknown.

Source: Resource Conversation and Recovery Information System (RCRIS) National Oversight Database,, September 19, 1995.

Priority rankings are unavailable in RCRIS for 6 percent of TSDFs (249 facilities) because they have not yet been ranked or their priority ranking has not yet been entered into RCRIS.

Exhibit 4-4 presents data for Subtitle C Indicator No. 2. It shows the number of facilities, by priority ranking, in each of two stages of the corrective action process: investigations and number of remedial actions to control contaminant releases. The data demonstrate that EPA is continuing to address the sites posing the greatest threats first. Since 1992, EPA has (1) conducted investigations at 86 additional high priority facilities, 53 additional medium priority facilities, and 26 additional low priority facilities, and (2) taken remedial actions to control contaminant releases at 177 additional high priority facilities, 48 additional medium priority facilities, and 5 additional low priority facilities. Overall, EPA has taken action to control contaminant releases at almost one-third of the high priority sites, one tenth of the medium priority sites, and two percent of the low priority sites. Although only 41 percent of the 1995 universe of RCRA TSDFs have high priority rankings, they comprise 76 percent of all sites at which stabilization measures have been taken or cleanup actions have been conducted.

New Indicators

The corrective action Subtitle C indicators 1 and 2 described above track process or administrative events that infer an environmental result. Since 1992, the corrective action program has made a significant effort to develop additional environmental indicator definitions that will track the actual environmental result of remediation activities.

Two new corrective action Subtitle C indicators have been developed and are expected to be reported by the end of FY 1997:

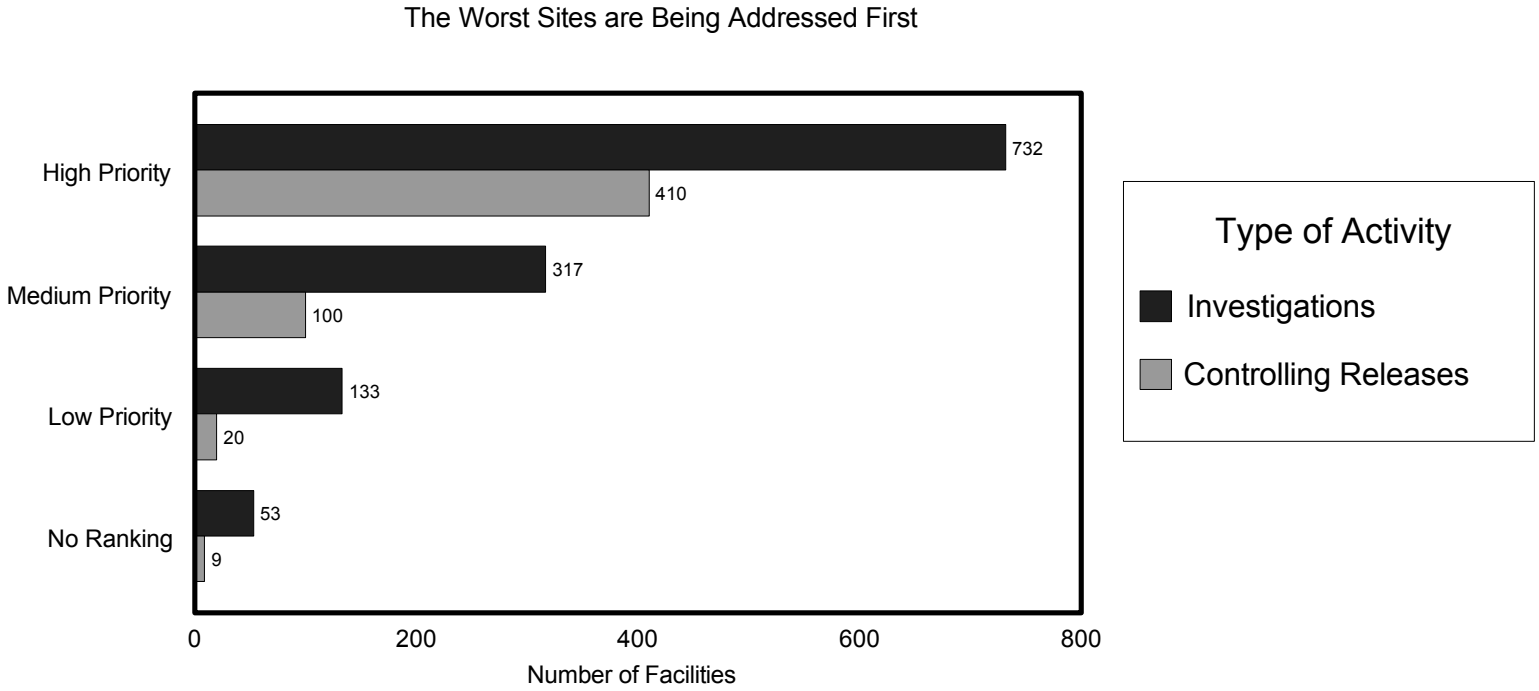
- Subtitle C Indicator No. 3. Number of Determinations of Human Exposures Controlled at RCRA Facilities.

- Subtitle C Indicator No. 4. Number of Determinations of Groundwater Releases Controlled at RCRA Facilities.

Two data codes were entered into RCRIS in FY 1994: Determination of Human Exposures Controlled and Determination of Groundwater Releases Controlled. The EPA Regions and States have just begun evaluating facilities for these new indicators. The EPA has the goal of evaluating all facilities that are currently undergoing corrective action by the end of FY 1997. These two results-based indicators will become the key reporting elements for the corrective action program in the future.

Exhibit 4-4.

Subtitle C Indicator No. 2. Number of Subtitle C Facilities Conducting Investigations and Controlling Releases, By Priority Ranking



High, Medium, and Low Priority refer to the corrective action (NCAPS) ranking of the facility.
Facilities include only Subtitle C treatment, storage, and disposal facilities (TSDFs).
Facilities may undergo more than one activity.

Source: Resource Conversation and Recovery Information System (RCRIS) National Oversight Database, September 19, 1995.

APPENDIX A

ACRONYMS

BDAT	=	Best Demonstrated Available Technology
BRS	=	Biennial Reporting System
CBI	=	Confidential Business Information
CMS	=	Corrective Measures Study
EPA	=	Environmental Protection Agency
FY	=	Fiscal Year
HHW	=	Household Hazardous Waste
MSW	=	Municipal Solid Waste
NCAPS	=	National Corrective Action Prioritization System
NPDES	=	National Pollutant Discharge Elimination System
OSW	=	Office of Solid Waste
POTW	=	Publicly-Owned Treatment Works
RCRA	=	Resource Conservation and Recovery Act
RCRIS	=	Resource Conservation and Recovery Information System
RFA	=	RCRA Facility Assessment
RFI	=	RCRA Facility Investigation
SIC	=	Standard Industrial Classification
TSD	=	Treatment, Storage, and Disposal
TSDF	=	Treatment, Storage, and Disposal Facility

APPENDIX B

INTRODUCTION TO ENVIRONMENTAL INDICATORS

This appendix provides a brief introduction to environmental indicators and their role in EPA programs.

WHAT IS AN ENVIRONMENTAL INDICATOR?

An environmental indicator is a measure of the quality of the environment and its ability to support human and ecological health Any biological chemical and/or physical measurement that describes environmental or public health conditions can be considered an environmental indicator. Environmental indicators also include measurements that do not describe environmental conditions explicitly but do measure factors known to affect environmental quality. Examples include measures of pollutant loadings to air and quantities of solid waste disposed on land.

WHAT IS THE ROLE OF ENVIRONMENTAL INDICATORS?

Environmental indicators can be used to provide information on (1) environmental status and trends and (2) the effectiveness of EPA programs in addressing environmental problems. Indicators can be used to assist in program planning and management, and to communicate with Congress and the public about the quality of the environment and how it has been affected by EPA's programs.

Information on environmental status and trends is necessary to identify emerging problems, assess their significance, and set priorities. One of the most important potential uses of environmental indicators is to assess the success of EPA programs. Data on environmental trends can be used to determine whether a program's activities are bringing about intended improvements in environmental quality. When environmental indicators are used to assess program performance, it is crucial to establish a cause and-effect relationship between program activities and changes in environmental conditions, and to isolate program impacts from the influence of extraneous factors.

Some EPA programs already use environmental indicators to evaluate program effectiveness; others have met with difficulties in linking program success to changes in environmental quality. The RCRA program is faced with a complex challenge in measuring program progress based on environmental results, since RCRA-regulated sites have localized impacts on several media, and the cause-and-effect relationship between program activities and environmental changes is difficult to establish for some major RCRA program components.

INDICATORS "CONTINUUM"

As discussed above, environmental indicators may be used to assess the effectiveness of EPA programs. Program progress also can be—and historically has been—assessed by monitoring the activities of the Agency or the entities it regulates. EPA has identified a continuum

of measures of environmental program effectiveness, shown in Exhibit B-1. At the left-hand side of the exhibit are activity measures, which measure actions taken by EPA or the States, or by the entities regulated by EPA or State programs. Examples of activity measures include the number of permits issued to hazardous waste management facilities; the number of inspections conducted or enforcement actions taken; and the number of sites at which groundwater monitoring systems have been installed.

To the right are environmental indicators, which are more direct measures of environmental quality. Those furthest to the right are direct measures of human health or environmental endpoints, such as the incidence of disease or the abundance of a species of wildlife in an area In the middle are measures of factors that contribute to human health or environmental endpoints which are also considered "environmental indicators", but are not themselves measures of those endpoints. Listed in decreasing order of their "directness" to actual endpoints are measures which include: uptake or body burden (such as lead levels in human blood), ambient conditions (such as concentrations of pollutants in groundwater near sites), and loadings or emissions (such as pounds of pollutants released to surface water). In developing RCRA environmental indicators, EPA will be working towards the right side of this continuum as data on actual environmental trends become available.

In the short term, the Agency will report more activity measures. Activity measures and environmental indicators both play an important role in program management and evaluation, and both are necessary. Activity measures provide a means for documenting Agency responses to legislative mandates and public pressure, both for internal purposes and for communications with Congress and the public. They are used to support short-term program management activities such as determining the amount of work completed and additional work needed to be done. Because environmental results are sometimes not manifested for years or decades, activity measures also provide a valuable record of actions taken to address environmental problems. The major shortcoming of activity measures is that they do not tell us whether the actions taken have had, or will have, the desired effect on environmental quality.

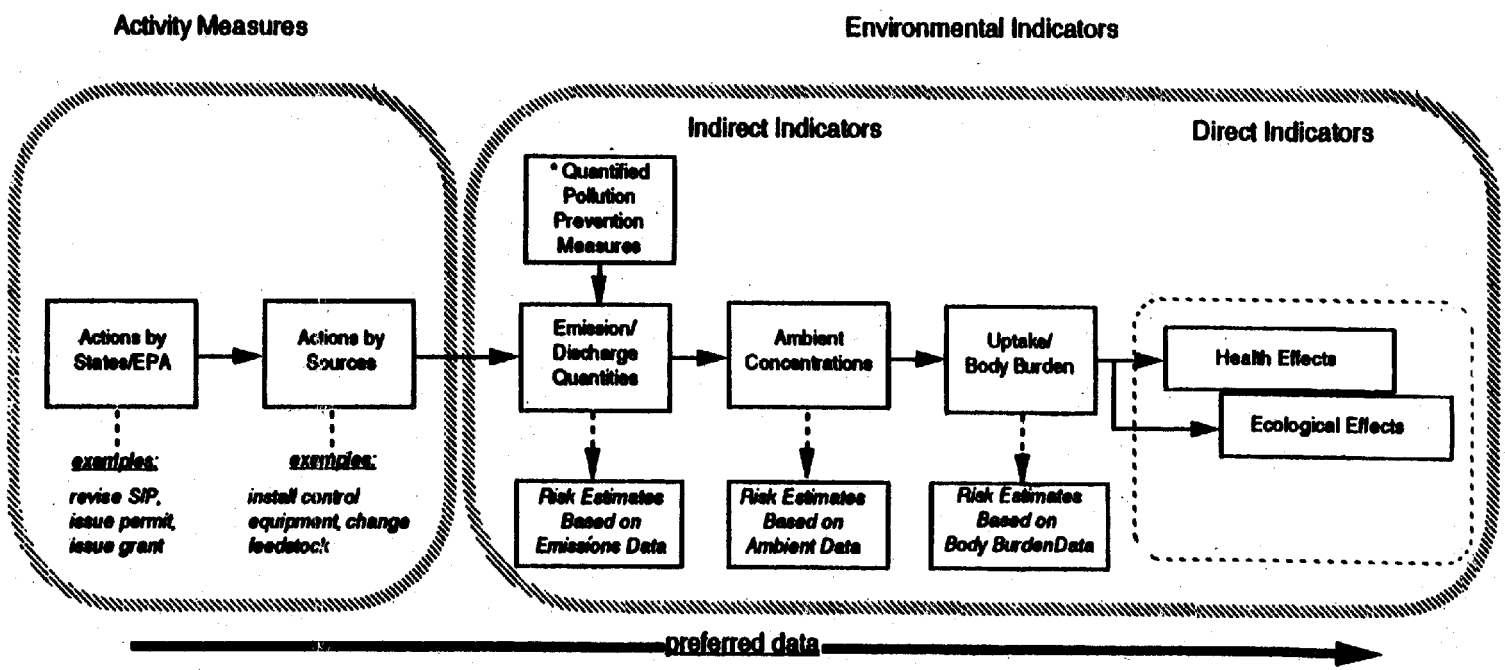
DISCUSSION OF ENVIRONMENTAL GOALS

In addition to reporting changes in environmental status, environmental indicators can also be used to measure progress toward specific environmental goals. The Agency has recently developed, and disseminated for government agencies' review, an initial draft of long-range goals for America's environment and measurable 10-year "benchmarks" (EPA's "Environmental Goals" report).[1] These cross-program environmental goals differ from EPA program-specific goals because they are not confined to the scope of a particular mandate or statute, but reflect more broad-based, cross-media concerns. The benchmarks represent what EPA believes can be accomplished with existing federal legislation and current resources.

---

[1]EPA. 1995. "Proposed Environmental Goals for America With Benchmarks for the Year 2005, Summary." EPA-230-D-95-001. Policy, Planning, and Evaluation. February 1995.

EXHIBIT B-1.
CONTINUUM OF MEASURES OF ENVIRONMENTAL PROGRAM EFFECTIVENESS



Theme 1: Managing for Environmental Results. Data to the right are closer to the "adverse ultimate impacts of pollution" that the States and EPA are charged with preventing or mitigating. All else being equal, data further to the right are better indicators of environmental result than data further to the left.

Theme 2: Emphasizing Pollution Prevention. Pollution prevention should result in the same kinds of environmental improvements as all Agency programs, so all these indicator types may be used to reflect pollution prevention successes. However, to prove the results are due to pollution prevention, data would be needed on the box marked with a *.

EPA will use the goals and benchmarks to develop long-range strategies and annual performance plans. The performance plans will contain environmental indicators for evaluating progress, and a report of progress to date. For cross-program goals that pertain to RCRA, OSW is working to develop appropriate indicators to measure RCRA's contribution towards achieving those goals. In fact, some of the indicators presented in the body of this report measure progress toward certain year 2005 benchmarks presented in EPA's Environmental Goals report (e.g., per capita generation of municipal solid waste; percent of municipal solid waste recovered for recycling or composting, percent of hazardous waste treated prior to land placement).

APPENDIX C

DISCUSSION OF DATA SOURCES

This chapter briefly discusses the major sources of data for the indicators reported in this document. Subtitle C indicators were based on data from the RCRA program's two major national information systems: the Resource Conservation and Recovery Information System (RCRIS) and the Biennial Reporting System (BRS).[1] Subtitle D indicators were based mainly on EPA's Characterization of Municipal Solid Waste in the United States.[2]

RESOURCE CONSERVATION AND RECOVERY INFORMATION SYSTEM (RCRIS)

Background

The Resource Conservation and Recovery Information System (RCRIS) directly supports the management of the RCRA Subtitle C program by Regions and States. It is a national program management and tracking system containing information on facilities that treat, store, or dispose of Subtitle C hazardous wastes, facilities that generate such wastes (both large quantity generators [LQGs] and small quantity generators [SQGs]), and those engaged in transporting such wastes. RCRIS contains information on facility identification and location, permit/closure status, compliance with Federal and State regulations, and clean-up activities.

State and Regional users update RCRIS on an on-going basis with current information as program activities occur. On a monthly basis, the RCRIS national database is updated to reflect State/Regional activity. Updates may occur as a result of several different types of activities; examples include receipt of notification information from a generator; inspection of a treatment, storage, or disposal facility (TSDF); and completion of corrective action stabilization measures at a site.

Data Quality

Indicators that are based on RCRIS data were developed with the assistance of State, Regional, and Headquarters personal who use and/or manage the data. These parties reached consensus on three criteria for selecting RCRIS data for indicators reporting (1) the data must be available in Headquarter' national oversight reporting database; (2) the data must be of high quality overall on a national basis; and (3) there must be a programmatically sound correspondence between the data and the indicator.

---

[1] Additional general information on RCRIS and BRS can be found in the *RCRA Hazardous Waste Information Management Executive Summary*, which also provides references for more detailed information.

[2] Additional information can be found in the report *Characterization of Municipal Solid Waste in the United States, 1994 Update, Final Report*, November 1994, U.S. EPA Office of Solid Waste.

Indicators included in this report draw on the RCRIS Corrective- Action module to identify program progress in that area, and the Compliance Monitoring and Enforcement module in support of safe management. The elements used for both indicators have high visibility from the standpoint of actual program implementation at the State/Regional level, and at Headquarters from a national program administration perspective. Projections for the quality of these data as a function of their timeliness, national completeness, and basic accuracy are strong. As with any national system, local variation in data quality may occur. However, by emphasizing data elements with high national priority, the impact of such potential variance is minimized. Efforts are underway to identify additions to RCRIS that can expand RCRA environmental indicator reporting capabilities. Subsequent reports will reflect those efforts.

BIENNIAL REPORTING SYSTEM (BRS)

Background

Every two years, LQGs and TSDFs are required to report to EPA on the quantity, composition, and disposition of hazardous waste, and on efforts undertaken to reduce the volume and toxicity of waste compared to previous years. EPA collects this information under the authority of Sections 3002 and 3004 of RCRA. Handlers provide this information to their State or EPA Region by submitting Hazardous Waste Report Forms.

Beginning with the 1989 reporting cycle, OSW developed the Biennial Reporting System (BRS), an automated data processing system that assists EPA and the States in compiling and maintaining the data from the Hazardous Waste Report Forms. States are responsible for collecting the information from facilities, reviewing it for consistency and completeness, and entering it into the automated system. EPA Regions conduct additional quality control and then transfer the files to EPA Headquarters, who loads the data into the national system.

Data Quality

OSW currently is using BRS data to report certain waste minimization and safe management indicators. In particular, information on industry classification, the quantity and type of waste generated, the management practices used for the waste, and the existence of a new, or expanded waste minimization program are reported in this document.

CHARACTERIZATION OF MUNICIPAL SOLID WASTE IN THE UNITED STATES

Background

Characterization of Solid Waste in the United States: 1994 Updateis the most recent in a 20 year series of reports sponsored by EPA to characterize municipal solid waste (MSW) in the United States. It provides information on MSW generation and management from 1960 to 1993;

MSW composition by volume and weight; and projections for MSW generation, combustion, and recovery through the year 2000.

The report characterizes the MSW stream of the nation as a whole and does not reflect local variations in waste generation rates, composition, or management practices. The information was derived using a materials flow approach This methodology is based on production data for the materials and products in the waste. Adjustments are made for imports and exports, product lifetimes, and diversions of products from the waste stream.

Data Quality

The information presented in this report is based on estimates rather than measurements of MSW generation and composition. Although the estimates are based on the best data available, they are subject to uncertainties associated with the methodology itself and the quality of the input data. In this ongoing series of reports' EPA has updated previous estimates if better information has become available, and will continue to do so.

Certain wastes that are frequently disposed in municipal landfills are not covered by the materials flow methodology. MSW as defined in this report does not include construction and demolition wastes, industrial process wastes, and a number of other wastes that may go to a municipal landfill. Certain other materials are also not included, such as product residues in containers (e.g., detergent left in a box). Therefore, the estimates of MSW generation presented in this report are typically lower than those found in other sources.

APPENDIX D

NEWLY IDENTIFIED HAZARDOUS WASTES

This chapter identifies wastes that became newly subject to regulation under Subtitle C of RCRA between the 1989 and 1991 Biennial Reporting System (BRS) reporting cycles. As discussed in Chapters 2 and 3 of this report, according to the BRS, more hazardous waste was generated and managed in 1991 than in 1989. An analysis of the BRS data indicate that this is not because the nation's hazardous waste generation rates actually increased, but instead because some of the wastes generated in 1989 were not regulated as hazardous until later.

Wastes that became newly subject to regulation under RCRA Subtitle C between the 1989 and 1991 BRS reporting cycles include:

- newly identified hazardous wastes characteristic for toxicity (D018-D043);
- spent by-product from chlorinated aliphatic hydrocarbon production (F025);
- wood preserving wastes (F032, F034, and F035);
- newly identified petroleum refining wastes (F037 and F038);
- multisource leachate (F039);
- unsymmetrical dimethylhydrazine (UDMH) wastes (K107-K110); and
- methyl bromide wastes (K131 and K132).

Newly Identified Hazardous Wastes Characteristic For Toxicity ("TC" Wastes)

These wastes were listed as hazardous on March 29, 1990 (55 FR 11798). The corresponding waste codes and descriptions are listed in Table D-1.

Spent By-product of Chlorinated Aliphatic Hydrocarbon Production

This waste was listed as hazardous on December 11, 1989 (54 FR 50968) and effective on June 11, 1990. The corresponding waste code and description are listed in Table D-2.

Wood Preserving Wastes

These wastes were listed as hazardous on December 6, 1990 (55 FR 50450) and effective on June 6, 1991. The corresponding waste codes and descriptions are listed in Table D-3.

Newly Listed Petroleum Refining Wastes

These wastes were listed as hazardous on November 2, 1990 (55 FR 46354) and effective on May 2, 1991. The corresponding waste codes and descriptions are listed in Table D-4.

TABLE D-1. TOXICITY CHARACTERISTIC WASTES

Waste Code	Description	Waste Code	Description
D018	Benzene	D031	Heptachlor (and its epoxide)
D019	Carbon Tetrachloride	D032	Hexachlorobenzene
D020	Chlordane	D033	Hexachlorobutadiene
D021	Chlorobenzene	D034	Hexachloroethane
D022	Chloroform	D035	Methyl ethyl ketone
DG23	o-Cresol	D036	Nitrobenzene
D024	m-Cresol	D037	Pentachlorophenol
D025	p-Cresol	D038	Pyrine
D026	Cresol	D039	Tetrachloroethylene
D027	1,4Dichlorobenzene	D040	Trichloroethylene
D028	1,2-Dichloroethane	D041	2,4,5-Trichlorophenol
D029	1,1 -Dichloroethylene	D042	2,4,6-Trichlorophenol
D030	2,-Dinitrotoluene	D043	Vinyl chloride

TABLE D-2. SPENT BY-PRODUCT OF CHLORINATED ALIPHATIC HYDROCARBON PRODUCTION

Waste Code	Description
F025	Condensed light ends, spent filters and filter aids, and spent desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to, and including, five with varying amounts and positions of chlorine substitution.

TABLE D-3. WOOD PRESERVING WASTES

Waste Code	Description
F032	Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that currently use, or have previously used, chlorophenolic formulations [except potentially cross-contaminated wastes that have had the F032 waste code deleted in accordance with Section 26135, and where the generator does not resume or initiate use of chlorophenolic formulations]. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol
F034	Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that use creosote formulations This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol
F035	Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that use inorganic preservatives containing arsenic or chromium. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.

TABLE D-4. NEWLY LISTED PETROLEUM REFINING WASTES

Waste Code	Description
F037	Petroleum refining primary oil/water/solids separation sludge—any sludge generated from the gravitational separation of oil/water/solids during the storage or treatment of process wastewaters and oily cooling wastewaters from petroleum refineries. Sludges generated in storm water units that do not .. receive dry weather flow, sludges generated in aggressive biological treatment units as defined in Section 26131(b)(2), and K051 wastes are exempted from this listing.
F038	Petroleum refining secondary (emulsified) oil/water/solids separation sludge— any sludge and/or float generated from the physical and/or chemical separation of oil/water/solids in process wastewaters and oily cooling wastewaters from petroleum refineries. Sludges generated in storm water units that do not receive dry weather flow, sludges generated in aggressive biological treatment units as defined in Section 26131(b)(2), and F037, K048, and K051 wastes are exempted from this listing.

Multi-Source Leachate

This waste is technically not a newly identified waste. In the final rule for the Land Disposal Restrictions for Third Scheduled Waste (June 1, 1990, 55 FF 22520), EPA decided to establish a separate treatability group for multi-source leachate, and to designate such leachate by its own waste code (F039). However, EPA clarified that this new waste code does not imply that such waste is newly identified, but rather that EPA is making a bookkeeping change as to the way it designates a type of waste that already is listed and identified. The corresponding waste code and description are dieted in Table D-5.

TABLE D-5. MULTI-SOURCE LEACHATE

Waste Code	Description
F1039	Leachate resulting from the treatment, storage, or disposal of wastes classified by more than one waste code under Subpart D, or from a mixture of wastes classified under Subparts C and D of this part. (Leachate resulting from the management of one or more of the following EPA Hazardous Wastes and no other hazardous waste retains its hazardous waste code(s): F020, F021, F022, F023, F026, F027, and/or F028.)

Unsymmetrical Dimethylhydrazin (UDMH) Wastes

These wastes were listed as hazardous on May 2, 1990(55 FR 18496) and effective on November 2, 1990. The corresponding waste codes and descriptions are listed in Table D-6.

TABLE D-6. UDMH WASTES

Waste Code	Description
K107	Column bottoms from product separation from the production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazine
K108	Condensed column overheads from product separation and condensed reactor vent gases from the production of UDMH from carbolic acid hydrazides
K109	Spent filter cartridges from product purification from the production of UDMH from carboxylic acid hydrazides
K110	Condensed column overheads from intermediate separation from the production of UDMH from carboxylic acid hydrazides

Methyl Bromide Wastes

These wastes were listed as hazardous in October 6, 1989 (54 FR 41402) and effective on April 6, 1990. The corresponding waste codes and descriptions are listed in Table D-7.

TABLE D-7. METHYL BROMIDE WASTES

Waste Code	Description
K131	Wastewater from the reactor and spent sulfuric acid from the acid dryer from the production of methyl bromide
D132	Spent absorbent and wastewater separator solids from the production of methyl bromide

APPENDIX E

REFERENCES

Biennial Reporting System. 1985 through 1991.

Resource Conservation and Recovery Information System (RCRIS). 1995. National Oversight Database. September 19, 1995.

U.S. Environmental Protection Agency (EPA). 1995. "Proposed Environmental Goals for America With Benchmarks for the Year 1995, Summary." Draft for Government Agencies' Review. February 1995.

U.S. Environmental Protection Agency (EPA). 1994. Characterization of Municipal Solid Waste in the United States: 1994 Update. Office of Solid Waste and Emergency Response. EPA 530-R-94-42.

U.S. Environmental Protection Agency (EPA). 1992. Characterization of Municipal Solid Waste in the United States: 1992 Update. Office of Solid Waste and Emergency Response.

Waste Watch Center. 1993.

Biennial Reporting System. 1985 through 1991.

Resource Conservation and Recovery Information System (RCRIS). 1995. National Oversight Database. September 19, 1995.

U.S. Environmental Protection Agency (EPA). 1995. "Proposed Environmental Goals for America With Benchmarks for the Year 1995, Summary." Draft for Government Agencies' Review. February 1995.

U.S. Environmental Protection Agency (EPA). 1994. Characterization of Municipal Solid Waste in the United States: 1994 Update. Office of Solid Waste and Emergency Response. EPA 530-R-94-42.

U.S. Environmental Protection Agency (EPA). 1992. Characterization of Municipal Solid Waste in the United States: 1992 Update. Office of Solid Waste and Emergency Response.

Waste Watch Center. 1993.